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De Forest on Radio Future—Page 648

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25 CENTS

POPULAR MECHANICS

MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT

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SEE PAGE 668

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INDIANAPOLIS, U.S.A.

"They last twice as long as the smaller batteries of equal voltage"

"That's a pretty broad statement, Tom. Won't you have to make it conditional on the number of tubes in the set or the use of the new power tubes?"

"No, sir! Under the same operating conditions—whether you use four, five tubes or more, whether you use a power tube that uses up to 135 volts, the Eveready Heavy-Duty No. 770 or the even longer-lived Eveready Layerbilt No. 486 will last twice as long as the smaller sized 45-volt batteries."

"Well, they ought to, they cost more."

"Yes, about a third more—but lasting twice as long as the smaller batteries, they cost much less."

"Your arithmetic is good, Tom, but if that's so, when I bought my set why did the dealer equip it with the smaller Eveready 772? Why didn't he put in the Eveready Heavy-Duty Batteries?"

"He probably thought he was doing you a favor — making your first investment cost you a little less. That little difference looks like a lot to a good many folks who are buying their first set, equipped with tubes, loud speaker, 'A' and 'B' batteries and everything."

Heavy-Duty batteries last twice as long as the smaller batteries of equal voltage. Eveready Heavy-Duty Batteries are the great contribution that the world's foremost electro-chemical laboratory has made in "B" battery economy, dependability and satisfaction, and the satisfactory reception of radio programs.

Dry "B" batteries give a noiseless current, pure D. C. (direct current), the kind that is essential if you prize pure tone.

Send for booklet, "Choosing and Using the Right Radio Batteries," which we will be glad to send you upon request. This booklet also tells about the proper battery equipment for use with the new power tubes. There's an Eveready dealer nearby.

LEFT - *Eveready Layerbilt No. 486.*

RIGHT - *Eveready Dry Cell Radio "A" Battery, 1½ volts.*

EVEREADY
Radio Batteries
-they last longer

NOTE: A "C" battery gives a quality of reception unobtainable without it and greatly increases the life of your "B" batteries.

Manufactured and guaranteed by

NATIONAL CARBON CO., Inc.
New York San Francisco
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WSAI—*Cincinnati*
WTAM—*Cleveland*
WWJ—*Detroit*
WGN—*Chicago*
WOC—*Davenport*
WCCO—*Minneapolis & St. Paul*
KSD—*St. Louis*

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Where Smoke and Dust Are Unknown; Passengers Dining in Comfort on Flying Journey from England to France; Artist's Sketch of Interior of Big Airplane Cabin at Meal Time

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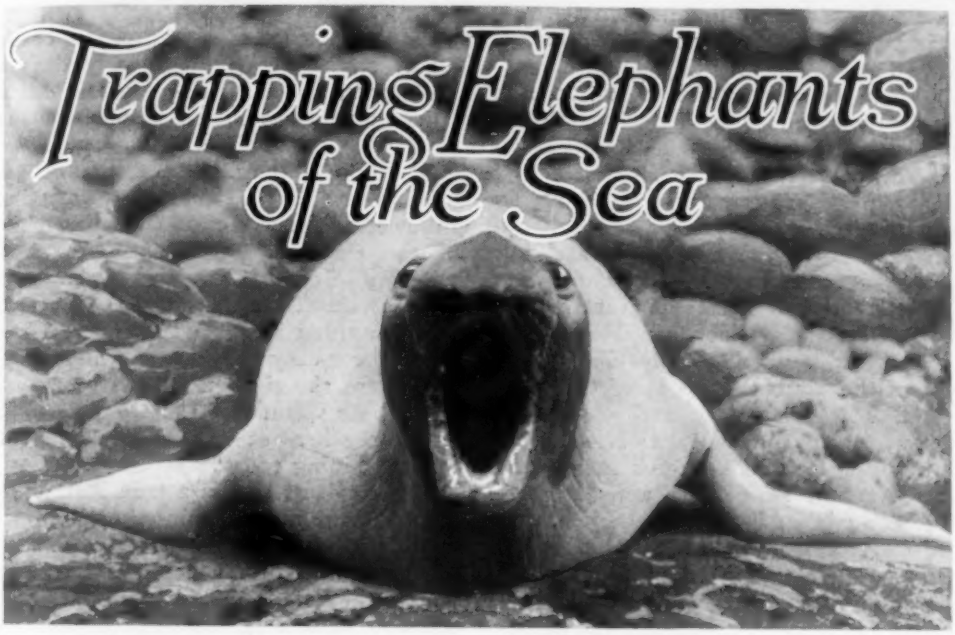
Trapping Elephants of the Sea



By ANDREW R. BOONE

"THE Marines have landed and have the elephants well in hand."

In these words might that famous message from the United States marines be paraphrased, and no levity intended. Uncle Sam's soldiers of the sea recently boarded the U.S.S. "Eagle No. 34" at San Diego, Calif., proceeded 240 miles south and west to Guadelupe island, 135 miles off shore from Lower California, and brought back three members of the only known herd of northern elephant seals.

They braved the perils of a Pacific storm and a rocky landing on the wind-swept island. A quarter of a mile from shore, where the little navy craft remained, the ocean was 10,000 feet deep, and thus anchorage was practically impossible. Crates in which the sea elephants were transported upset; their man-powered whaling boat that they rowed from ship to island and back again, capsized; they worked in chilling water for hours and defended themselves against the sharp teeth of 6,000-pound seals—and returned with the last trophies the Mexican government will ever permit to be taken from the shores of Guadelupe.

As the first step in capturing sea elephants for the San Diego Zoological society, the marines made fast to the motor dory three crates, made of heavy wire screening and wood. After a battle with the waves, the crates were landed and then came the task of inducing the animals to enter captivity.

Lieut. E. W. Dort, U. S. N. reserve, in charge of the expedition, had the men spread out wire wings toward the elephant which was driven into the cage

after much prodding. The same procedure was followed with two others. Then, by man power, the crew dragged each crate to the edge of the water. At that point barrels were lashed to each side to float the captives to the boat where they were slung aboard easily by means of a crane.

Difficulties greater than any physical dangers of catching and transporting the sea elephants were found in their feeding, members of the party reported. The seals eat live fish only, when in their wild state, and when, on a previous expedition, one was being taken from Guadelupe to the United States, it soon died because keepers did not know how to feed it.

Zoologists had attempted to learn, by examining the stomachs of those found dead on the beach, what they ate, but nothing other than black, volcanic sand was ever discovered. Apparently they frequently fasted for considerable periods. Lieut. Dort, by virtue of a former experience of the kind, was prepared to force-feed these three prizes, and soon after they were deposited aboard "No. 34," all were eating and looking for more dead fish. At San Diego the animals were hoisted again and again let down, this time on a motor truck, which bore them safely to an artificial pool of salt water where they will spend the rest of their lives.

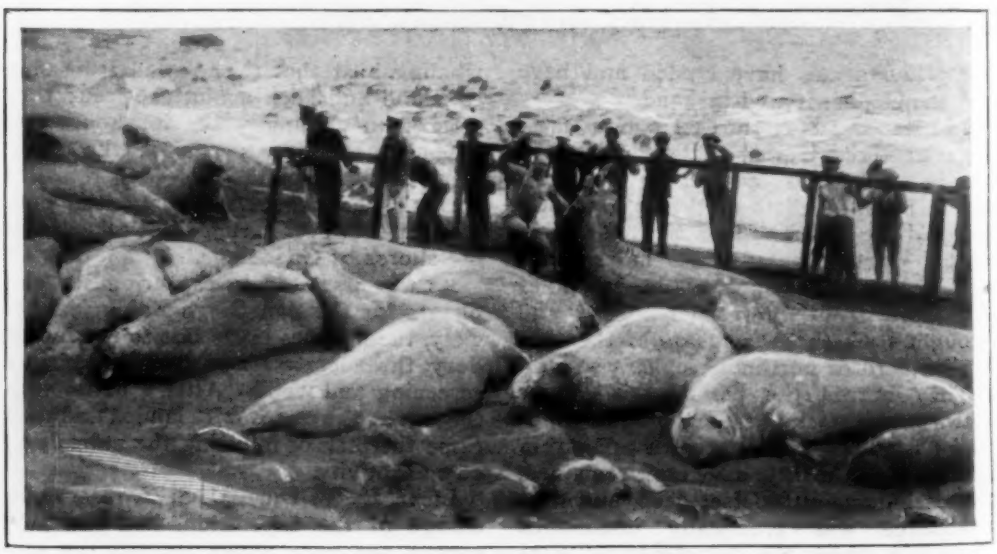
Guadelupe island, named for the patron saint of Mexico, is of volcanic origin and lies far away from the lanes of travel. The first inroads there took place in the late eighteenth century when fur seals were discovered. Until 1830 they were subjected to annual raids by sealers who built stone houses on the island and completely depleted the fur-seal herds.

Next came whalers, presumably only to fill their waterbags.

After the whalers came hunters of elephant seals. During the early days of California, the demand for whale oil for lighting purposes soon exceeded the supply. Whales became scarcer and were found only in more distant regions. It was about this time that some ingenious follower of the sea found that the blubber of the elephant seal contained a large quantity of oil.

The natural sluggishness of these animals, sunning themselves on the beach, made them easy prey for the killers, and they were slaughtered by the thousands, to become victims of the try pot. As a result, the herd at Guadelupe is the only one remaining today.

The elephant seal is a true seal, differing from the more commonly know varieties by its great size and by the presence on the adult males of a short trunk, from which they derive their name. Unfortunately, little is known of their habits.



Trying to Isolate a Prize Specimen from the Herd; Using Barriers of Wood and Wire to Surround Elephant Seal and Direct It toward the Cage

Folding Monoplane with One Side of Wing Laid Back against the Fuselage

MONOPLANE THAT FOLDS UP FITS INSIDE GARAGE

Successful test flights with a folding monoplane are reported from Roosevelt field, Long Island. The wing can be bent back flat against each side, reducing the width from forty-four feet to twelve and one-half so that the plane can be housed in an ordinary garage. An additional feature is an air brake on the wing, which makes it possible to reduce the speed considerably in landing and thus to stop the plane in a shorter distance.

TRAFFIC JAMS COST NEW YORK MILLION DOLLARS DAILY

In New York city, loss by traffic congestion costs its citizens $1,000,000 a day, according to estimates, and $600,000 every twenty-four hours in Chicago. The problem has a direct relation to the high cost of living, for the expense of delivering products affects the price to the consumer. In one center, it is said to cost as much to distribute potatoes from the freight station among the buyers as it does to haul them 1,000 miles by rail. Six cents a minute is the approximate expense of keeping a motor truck of average size on the streets, whether running or not, according to careful figuring. A small car will consume one gallon of gasoline in forty minutes of idling. A large taxicab company states that it would save $100,000 a year in gasoline if it could save only two minutes on each trip. Public-transport concerns must provide a large number of units to offset delays caused by traffic congestion. Lack of parking space is an additional costly result of clogged streets to the other inconveniences and expenses which must be borne by the ultimate consumer. It is evident, therefore, that the traffic problem affects all citizens.

ELECTRIC FAN FOR CLOSED CARS RUNS ON SIX VOLTS

Among recent accessories for the comfort of the autoist, is a six-volt electric fan that may be attached to the interior of the car. It affords healthful ventilation and a cooling current when the auto is stopped in congested streets on warm days.

Electric Fan Installed in Auto; It Operates Efficiently on Only Six Volts

UKULELE WITH HINGED NECK FOLDS INTO HANDBAG

Ukulele in Use Resembles Ordinary Instrument with Round Head; Inset Shows How Neck Folds

Measuring but nine inches long when folded, a patented collapsible banjo-ukulele can be carried in a handbag, where it is less bother and not so likely to be damaged on outings. The neck is on a hinge, is quickly opened for playing and the folding feature is said not to detract from the tone quality. An attractive design is painted on the instrument.

BALANCE OF HEAT AND HUMIDITY FOR COMFORT

Tests at the bureau of mines in Pittsburgh, Pa., have established what experts declare to be the proper balance of heat and humidity favorable to the greatest human comfort. In perfectly still, saturated air, a temperature of sixty-four degrees is the most satisfactory to the average person of European race, the measurements indicated. Two degrees more are necessary for complete comfort if the air is only eighty-per-cent saturated, and if the moisture is reduced to fifty per cent, sixty-nine and one-half degrees are needed. Such conditions were held comparable to those of an ideal day in May or June. With a relative humidity of twenty per cent, the comfort line lies slightly over seventy-two degrees. The "still" tests represented only half of the problem, for when the air is moving, a higher temperature is necessary since the skin is cooled by the evaporation induced by air movements. The experiments showed that a temperature of seventy-six degrees with a relative humidity of forty-five per cent, when the air was drifting 340 feet a minute, was just as comfortable as a temperature of seventy degrees in perfectly still air of the same degree of humidity. At eighty degrees and a relative humidity of fifty per cent, the air had to be circulated several times as fast as in the preceding test, to give equal comfort. The amount of clothing and the activity of the person, change these "comfort levels."

ELECTRIC REVOLVING TABLE HELPS GATHER REPORTS

An electrically driven revolving table is being used in the department of agriculture at Washington to facilitate the collection of separate sheets of reports into complete

Revolving Table Used in Government Department to Enable O'd Employes to Do Work of Gathering Pages of Reports While Seated

groups. Formerly the stacks of sheets, as they came from the printers, were laid out in rows on long tables and the workers walked down the row, taking a sheet from each pile. The process involved much loss of time and required strong employes to stand the continuous walking. The

Capt. Bleasdale and Machine Gunner Demonstrating Accurate Fire; Holding Target, the Captain Advances toward the Gun While Bullets Whiz Close By; Inset, Supporting a Dummy Figure in Accuracy Test

revolving table now in use brings the sheets to the workers, and enables the employment of aged and crippled government servants, who otherwise would have to be pensioned. At the end of the revolution a complete copy is gathered.

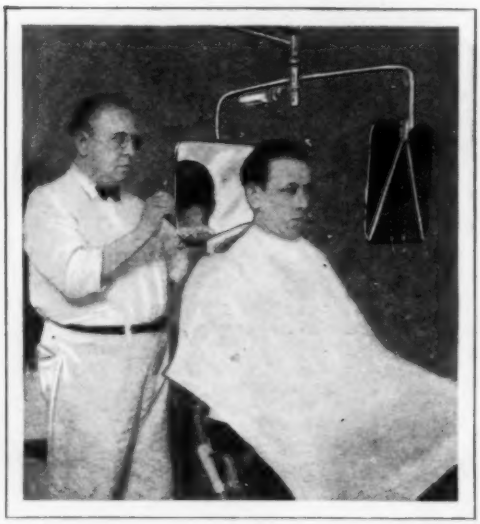
BIG STEAMER WITH NINE DECKS LAUNCHED IN FRANCE

One of the largest vessels afloat is the "Ile de France," a 40,000-ton ship with nine decks. The hull has the approximate height of a twelve-story building. The steamer is considered an innovation in French maritime enterprises as, heretofore, emphasis has been on elegance and comfort rather than size.

MARINE FLIRTS WITH DEATH TESTING MACHINE GUNS

Walking down a ten-inch lane between machine guns spitting lead, Capt. Victor Bleasdale, of the Marine corps, seemingly invites certain death in his daily work at Quantico, Va. He does it to show that the bullets do not vary in direction after discharge, and to convince recruits that they could walk safely close to a protecting machine gun barrage in making attacks on an enemy. The secret of the test is to walk straight. In another demonstration, he holds a man-size target while bullets shoot over the head of the dummy, showing that fire directed close above advancing soldiers would not harm them.

PATRON WATCHES HIS HAIRCUT IN DOUBLE BARBER MIRROR



Double Mirror in Use; It Affords Both Front and Rear View, and Is Easily Turned Out of Way

Raised or lowered by a pulley, a special mirror arrangement over the barber chair affords the customer a view of the entire haircutting process. The glasses are quickly swung out of the way and do not interfere with the barber's movements.

PORTABLE BOAT FOR BATHING FOLDS INTO SMALL BAG

A sailboat that can be folded into a small case for carrying is one of the latest accessories for the bathing beach. It is brilliantly colored, weighs but twenty-five pounds and contains balsa wood, the light tropical product more buoyant than cork. It is said that the craft is constructed to serve as a life preserver for four persons, should such use be necessary. Besides the sail, which can be erected in three minutes, a wooden paddle is furnished. The boat folds up on brass hinges and is only three feet in length when closed, so that it can be carried in a car without projecting.

Swimmer with Boat and Craft in Bag

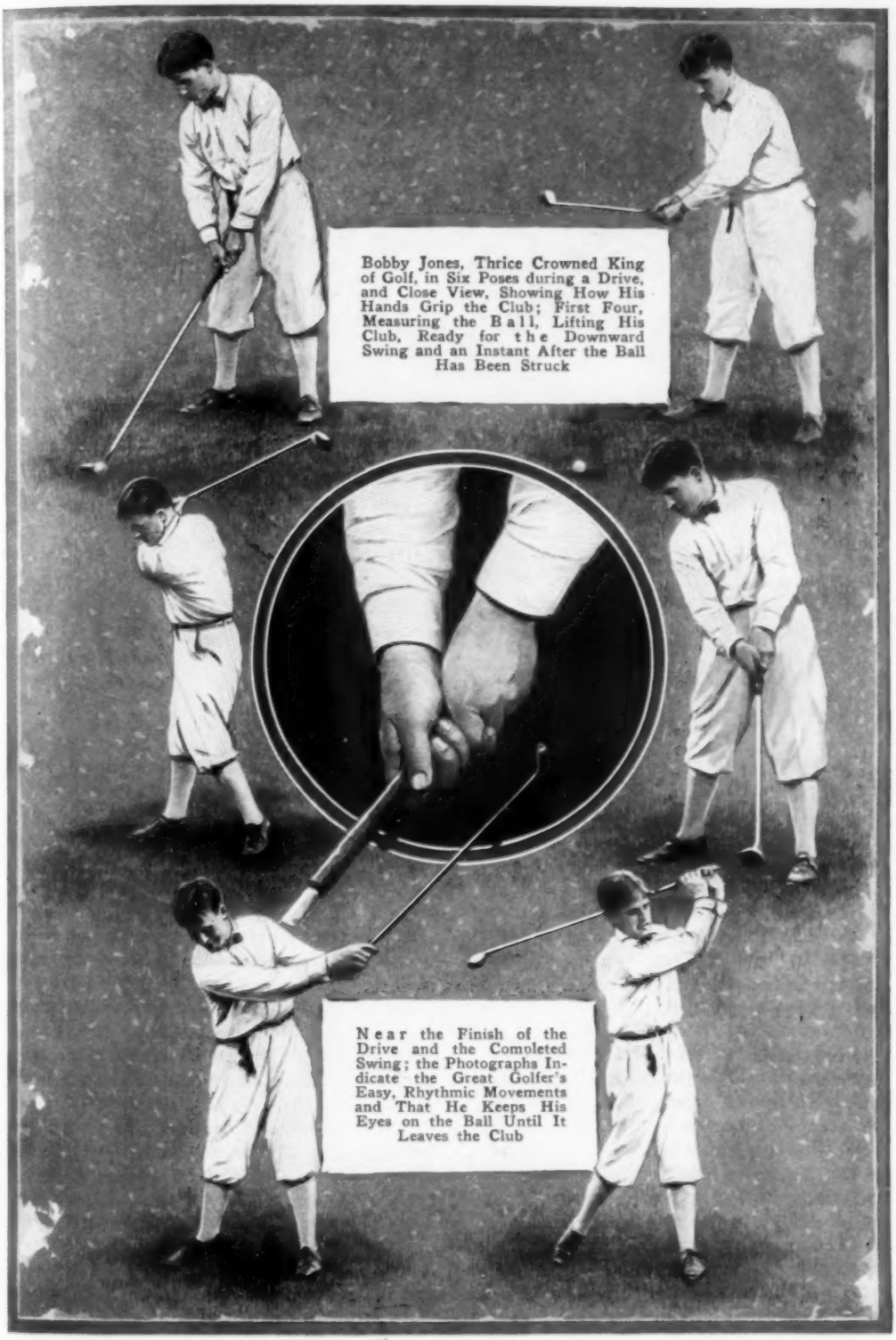
BRACELET OF COCONUT SHELL LATEST FAD IN EUROPE

Coconut-shell bracelets, studded with precious stones and ornamented with gold or platinum, have become popular in European fashion centers. Those from the South Sea islands are considered the best, as they are less likely to break. To make the bracelets, the nuts are gathered about a month later than usual, the inside is scooped out and the shells buried in clay soil for six months to improve the grain. From fifteen to twenty bracelets of different sizes can be cut from some of the larger nuts. They are finished in various patterns, and the more elaborate ones are priced at several thousand dollars, depending largely upon the value of the stones with which they are decorated.

NEW WAY OF FREEZING FISH PRESERVES THEIR FLAVOR

By immersing fish in brine baths then freezing them quickly at low temperature, chemists are reported to have discovered a way of preserving them without any loss of flavor. Laboratory tests indicated that fish so treated would keep in good condition for two years. Under old methods, large crystals, formed during the freezing, puncture the delicate tissues, permitting certain fluids to escape and thus spoiling the flavor. Persons blindfolded and asked to taste, alternately, fresh fish and those prepared by the improved process, are said to be unable to detect any difference. After the fish are frozen, they are wrapped in parchment paper. No metal except aluminum is allowed to touch them. Cross-country shipping of fish thus is thought possible.

HERE'S HOW WORLD'S CHAMPION GOLFER DRIVES



Bobby Jones, Thrice Crowned King of Golf, in Six Poses during a Drive, and Close View, Showing How His Hands Grip the Club; First Four, Measuring the Ball, Lifting His Club, Ready for the Downward Swing and an Instant After the Ball Has Been Struck

Near the Finish of the Drive and the Comoleted Swing; the Photographs Indicate the Great Golfer's Easy, Rhythmic Movements and That He Keeps His Eyes on the Ball Until It Leaves the Club

ELECTRICAL VOICE IS GIVEN THE CHORUS GIRL

Apparatus Installed in Orchestra Pit, as for Reproducing Voices of a Musical Chorus Number, and Examining Details of the Recorder

THAT nature does not put all her eggs in one basket is again instanced in the assembling and training of a chorus for a musical revue. Some girls are good-looking, some are graceful, some are excellent dancers, and some can sing; but to seek a combination of all these attainments in one chorus girl is to ask for the impossible. So a well-known producer of musical comedies decided some time ago to raise the vocal side of his presentations to the same high standing as the other features. Realizing that even if a chorus girl could sing, the physical effort might be too much in addition to dancing and acting, he sought the aid of scientists in evolving some means of supplying the desired vocal effect. The electrical reproducing device now available for home use caught the fancy of the producer, and he immediately set to work on a plan for utilizing this general idea on the vast scale necessary for theatrical purposes. First, to meet the requirements of ample volume, to overcome the sound absorption of scenery, upholstery, draperies and closely packed audience of the theater, the power of the electrical voice, for such it is in truth, was increased tenfold. Even so, the volume was insufficient, especially as a complementary chorus to accompany the supporting orchestra, to be clearly heard. Then a hundredfold increase was tried and proved more than ample. Indeed, on the outdoor tests the electrical voice was heard at a distance of seven miles. Meanwhile, the producer commissioned the recording studios to attend to the vocal

numbers. The best vocal talent was secured, trained in the quiet and orderly studio, and the polished performance recorded by the light-ray method, which assures a faithful record of exact rendition. It might be added that the light-ray apparatus consists of a minute mirror which vibrates with the impact of the sound waves striking a minute aluminum cone, thus sweeping a group of light beams more or less into the slots of a photoelectric cell. The latter has the property of varying its electrical conductivity according to the light which reaches it. Thus the sound values are translated into electrical values and delivered to an electromagnetic cutting tool, which, vibrating accordingly, engraves the soft-wax master record with a corresponding wavy groove. In due course, therefore, the producer obtains the necessary records for his vocal numbers. Perfectly synchronized, perfectly matched in pitch, the electrical voice has blended with the usual chorus and the supporting orchestra so perfectly that even the critics attending the first-night performance were unaware, at first, that the vocal effect of the chorus was assisted by mechanical means. The voice starts with a disk record which, in outward characteristics, seems much like the usual home-phonograph record. It is placed on a motor-driven turntable. An electromagnetic pick-up or reproducer translates the wiggles of the needle into corresponding electrical wiggles or variations, which in turn are amplified. The final stage of amplification makes use of a 250-watt tube—power comparable to that of many first-class broadcasting stations. The amplifier output is sent to cone reproducers in the theater. The entire equipment is in duplicate, to guard against possible breakdown. An operator stands by the mechanism, which is placed beneath the stage or in some other place, invisible to the audience.

More Comfort for the Baby and Mother While Traveling; Crib at End of Parlor Car

CRIB IN RAILROAD PARLOR CAR LATEST TRAVEL CONVENIENCE

Spacious cribs attached to the wall at one end of parlor cars in service on a southern railroad have proved of great aid to mothers caring for babies while traveling. They have railings to keep the infant from falling out, are comfortable and sufficiently roomy to provide the child with ample playing space.

INFLATED CAP HELPS SWIMMING

Cap, Inflated, Is Easily Slipped On or Off and Is Securely Held by Chin Strap

Buoyant rubber caps for bathing keep the head up so that the beginner is encouraged to be less timid and the experienced swimmer can float more easily. The cap is helmet-shaped, fitting well over the ears to keep out the water; the air-inflated double walls are soft and comfortable, and the protector is slipped on or off easily.

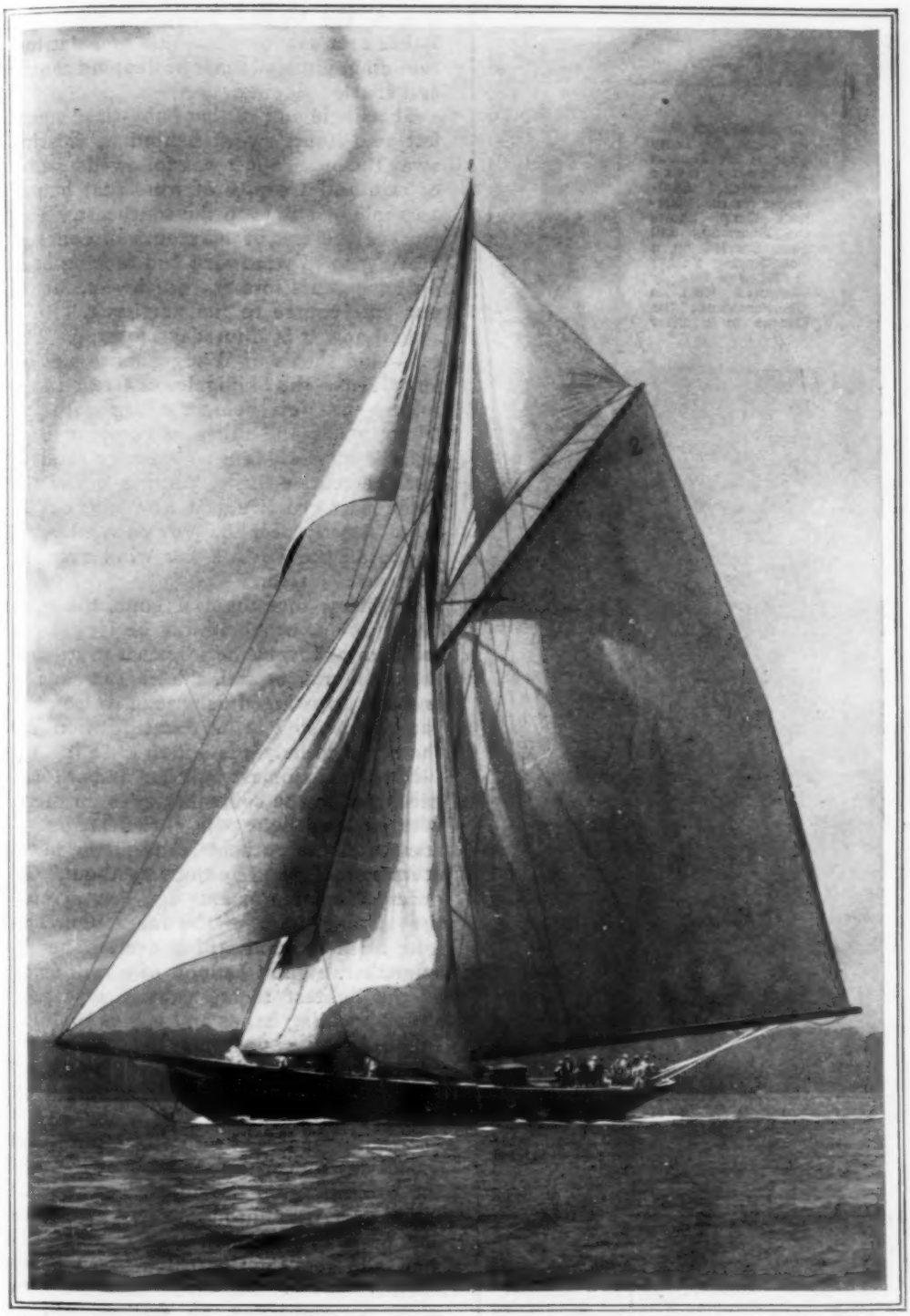
Stand By to Come About!

With Spinnaker Set and Wind on Quarter the Yacht Heads for the Finish

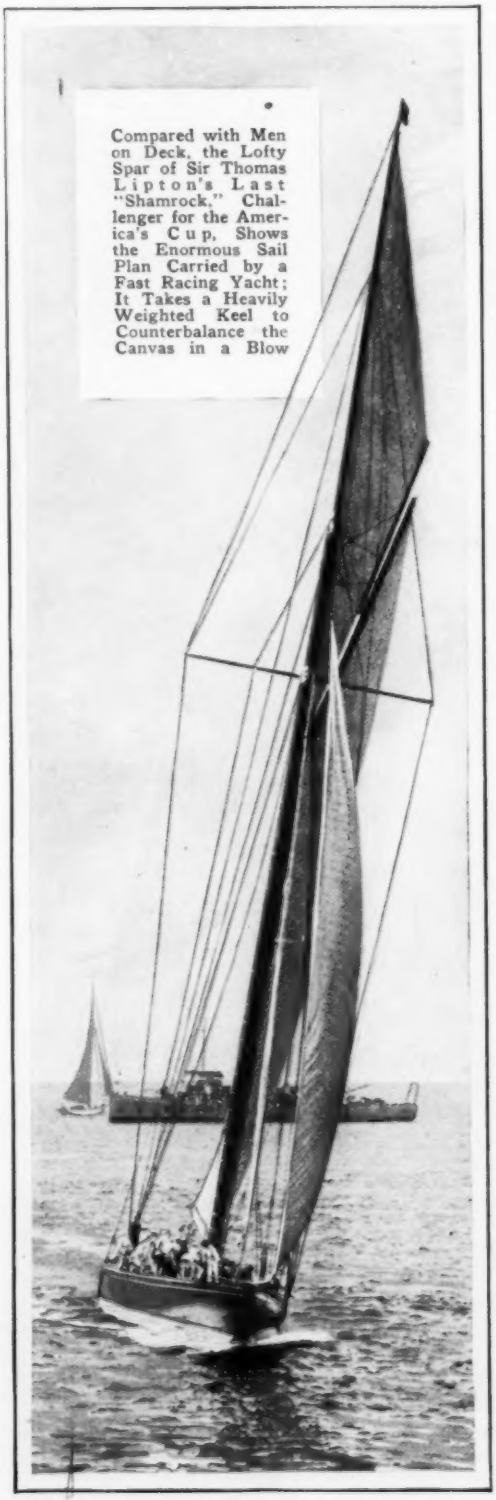
By J. EARLE MILLER

"OUT spinnaker and ease the sheets!" The skipper, from his post at the wheel, barks the best command the racing crew of a fore-and-after ever hears. The starboard watch is on, but the port watch comes tumbling up from below to lend a hand, for luck has changed, after four days and five nights of waiting, and now, almost in sight of the finishing line of the world's longest fresh-water yacht race, we've got a freshening breeze on the quarter to blow us into port, all our light racing canvas drawing. Not all, rather, but most of it, for last night, to climax one of the slowest, most exasperating races ever run in the nineteen years of Chicago-to-Mackinac island duels—the classic of the Great Lakes—a three-minute squall popped up out of the southeast, snapped our fore topmast off three feet below the peak and sent our giant reacher and

Nova Scotian Fishermen Are Stanchly Built to Weather the Rough Sea of the Grand Banks, and Carry Enormous Sail Spreads; This Is "Bluenose," the Canadian Fishing-Cup Defender



Slipping Along in a Light Breeze, with More Sail Being Set, a Cutter Presents a Beautiful Sight; This Is the Favorite Rig for Large Racing Yachts Abroad; It Points in the Wind as Well as a Sloop and Has a Big Canvas Spread Approaching That of a Schooner



Compared with Men on Deck, the Lofty Spar of Sir Thomas Lipton's Last "Shamrock," Challenger for the America's Cup, Shows the Enormous Sail Plan Carried by a Fast Racing Yacht; It Takes a Heavily Weighted Keel to Counterbalance the Canvas in a Blow

one of the biggest fishermen the Great Lakes ever saw over the side in a slatting, tumbling, jumbled mass of flapping canvas and snarled rigging.

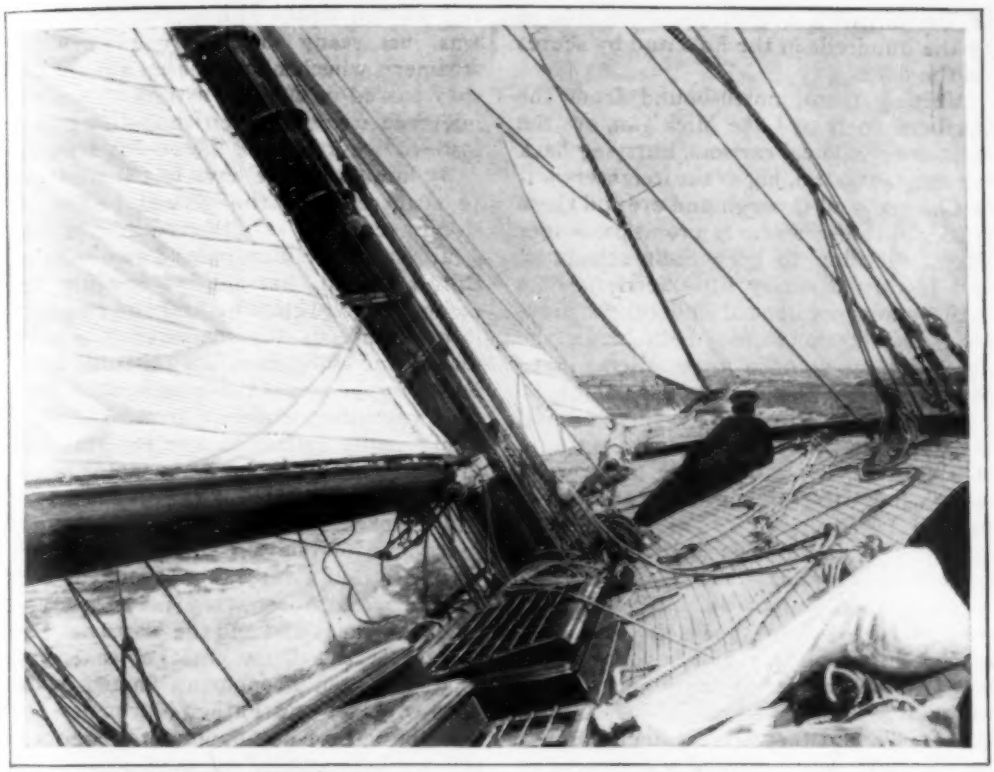
The single puff of that baby-sized squall left two hours' work behind it, clearing away the mess, but it was followed by a bit of rain and a capful of wind that hauled a couple of points to the southeast. This marked the end of 105 hours of constant beating up to windward and tacking back on long slants into the northwest, far off our true course to the northeast.

And now it is Thursday morning. The reefs and shoals of Waugoshance and Ile aux Galets—the Skilligalee of Great Lakes sailors—are left behind, along with the tricky winds and calms of Sleeping Bear point and the Manitou passage, and at last the telltale bit of bunting below the main mast crosstrees is whipping out to point directly over the port bow, advertising to all the world a fair wind over the starboard quarter.

With our fore topmast gone, the spinnaker boom, which should be rigged out to windward from the foremast to balance the main and foresail, the jib and staysail and the jury-rigged fishermen to leeward, can't be hoisted in its usual position, for there are no halyards left to raise it.

But the mainmast still has a spare halyard, and so the spinnaker goes up there, with its long, light pole, thrust far out to starboard, the outhaul ready in the block at its end. "Stand by to come about," the order of a few moments ago, has marked the turning point of the race. Our last long hitch to windward is over. The big spinnaker, a giant balloon of a sail, made of the lightest racing canvas, is hauled aloft by willing hands and begins to draw. Inboard, its peak spills the freshening breeze into the belly of the jury-rigged fisherman—one advantage of having it on the mainmast—and we are on our way.

A sailor speeds aft to the fantail and squats down over the recorder of the patent log, calling off the mileage to another standing by the chronometer. Five minutes pass, and the man at the clock calls time, and gets the figures back. A hasty calculation—the difference between two readings, multiplied by twelve—shows eight miles an hour, and the wind is freshening a bit as it hauls farther to the south.



"White Heather" Chasing "Lulworth" Home in a Stiff Breeze at Plymouth, England; with Everything Drawing and Decks Heeled Over, the Low Freeboard of the Yachts Is under Water to Lee

The next five minutes we foot along at nine miles, just about the best we have done since last Saturday night, when, eight hours out from the starting line, we rode out a four-hour squall with lee rail under, water swishing around the cabin trunk, and the bow bringing up tons and tons of green seas as it dipped into each choppy roller. We rode it out with our heavy canvas on, even up to a jib topsail, and logged better than twelve miles an hour—while it lasted—and that's not bad for the "Rainbow," our ex-Nova Scotian fishing schooner, built to battle heavy seas off the Grand Banks, but not for piling up the miles in fair-weather racing.

The main and foresail, eased far off to port to balance the hefty spinnaker, are drawing perfectly now, and the little four-bladed "spinner," trailing 125 feet astern at the end of the log line, turns over and over as it is dragged through the water, transmitting, through the twisting line, steadily mounting figures to our patent log—the speedometer of a ship.

We've left St. Helena, a pretty little island, astern, and off the port bow, five miles away, the lookout sights the bobbing iron-work tower of the Graham shoals gas buoy, the turning point where we will enter the Straits of Mackinac, better known as the Great Lakes' counterpart of the corner of Forty-Second and Broadway.

Down the straits, from the opening of navigation in the spring to the coming of the ice in the winter, there rolls a constant procession of huge lake-type freighters, 600-foot steel giants, loaded with their 12,000 tons of iron ore, bound for the blast furnaces of South Chicago and Gary. They come out of the northwest—downbound from Lake Superior ports—pass Mackinac island under the whitewashed walls of the old fort, where the flags of France and later of England once flew, swing into the straits and join the parade from the lower lakes. There are big coal carriers from Ohio ports, bound for the Wisconsin shore, and equally big ones out

of Detroit, with new automobiles stowed by the hundreds in the hold and by scores on the deck.

Meeting them, north-bound from the southern ports of Lake Michigan, are the empty ore and coal carriers, hurrying back for another cargo, big grain freighters out of Chicago, and through and around these trucks of the seas scurry proud passenger liners, speeding to keep their schedules, and important, fussy little ferries, some with passengers aboard and others moving railroad trains from old Mackinaw, the northernmost point in lower Michigan, to St. Ignace, the tip of the upper peninsula.

From our position, we see them all and are glad the breeze is bowling us along at a good speed, with plenty of steerage way to dodge the lumbering red and black-painted freighters, for they are slow to give way for anything as small as our fifty-three-foot schooner. Last night, just before the moon popped up to lift the darkness around White shoals, a 500-footer, loaded with flivvers, came charging down, way off the regular steamer course, and for an anxious fifteen minutes it looked as though we and they were going to run a dead heat for an unmarked watery spot in the lake. Flashlights, played on our white canvas to supplement the usual running lights, had no apparent effect, and a red Coston light, with cap snatched off, was just ready to be struck when the steamer's wheelsman came up a point and they passed us 200 feet astern. That was one race we won, even though we have lost—as we know we have—this one.

By how much we have lost it we begin to suspect when the glasses pick up a sloop scudding southward down the straits, eight or nine miles away, with all canvas furled, her engine sending her along at a good clip. By hull and rigging it is unmistakably the schooner "Gaviota," one of our worst enemies. Headed home under power means that she finished some time yesterday, while we are still bowling along under sail, with the regatta committee seals on our auxiliary motor intact.

The homebound "Gaviota" is the first of the fleet of fourteen we have seen for more than two days. Tuesday, while still trying to find a favorable breeze far over on the west shore, many miles south of Washington Island and the Porte de Mort —the "Death's Door passage" that some long forgotten Frenchman named in the days of Joliet and Father Marquette—we saw the last of our opponents. She was the yawl "Jeanette," sighted some miles ahead and several to windward, close inshore and still beating northward, when we caught a favorable wind to blow us

Getting In the Spinnaker Is a Job for Many Hands; as the Halyards Are Slackened Away, the Great Folds of Fluttering Canvas Must Be Subdued and Brought Down to Deck

across the lake to the usual Mackinac course, around Point Betsy and the Manitou islands.

We learned later she kept on north clear to the Whiskey Islands, and then bore east to beat us across the finish line by less than two hours.

While we watch "Gaviota" chugging southward, "Rainbow" breasts the gas buoy off Graham shoals, the helmsman spins the wheel hard over and we trim sail and point up for the finish line, in plain sight seven miles ahead. A long string of signal flags, whipping in the breeze from the tall wireless mast atop the highest hill above Mackinac fort, spell out a welcome in international code.

Beneath the fort on the narrow strip of beach nestles the town, and at the water's edge the glasses pick out the tent of the regatta committee, pitched beside a flagpole from which flies the burgee of the yacht club. A lone committeeman, lounging on watch in the shade, comes to life, and through the binoculars we watch him slip a shell into the signal gun and stand by, lanyard in hand, ready to give us the finish signal.

The skipper, at the wheel, orders the crew to stations ready to take in the spinnaker as soon as we get the gun. A puff of smoke leaps from the signal gun and on its heels we get the report. Down spinnaker and stand by to take in the fisherman, foresail and the main topsail. A sailor at the chronometer calls the time, 12:43 o'clock. We made it in four days, twenty hours and forty-three minutes.

Under main sail, jib and staysail we glide up the harbor, passing across the bows of the sloop "Intrepid." No need to ask the name of the winner—from the tip of her lofty Marconi spar she flaunts a broom, and one of her crew calls across the news that she won that more than 300-mile race by ten seconds!

That's yachting on fresh water.

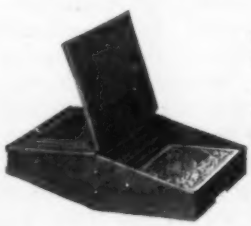
Umbrella Bag Open, in Carrying Position and Loaded with Articles for the Beach; It Is Light and Waterproof

Courtesy American Exporter

FANCY PARASOL FOR BATHERS ALSO SERVES AS BAG

Besides keeping the sun from the bather while on the sands, a brightly colored rubberized parasol may be used as a bag for taking articles to or from the beach. A wet bathing suit, for instance, can be tucked inside and will not drip, and other things may be carried. A string connects all the ribs of the parasol, to bind them together when it is used as a carrier.

BOX FOR SHUFFLING CARD DECK REQUIRES NO SKILL



Cards are mechanically shuffled in a box containing compartments which mix them thoroughly as the holder is moved up and down. A small door which closes tightly prevents the cards from falling out. The device insures a good shuffle and eliminates possibility of stacking deck

SUB'S WRECKAGE TELLS MUTE STORY OF TRAGEDY

Secure at Last in Drydock at New York, the "S-51" with Two of the Pontoons That Helped Litt It from the Ocean Floor; the Gash Cut by the "City of Rome" Is Visible in Front of Conning Tower

Examination of the "S-51" has shown the crew's efforts to prevent sinking when the submarine was rammed by the "City of Rome," Sept. 25, 1925. According to testimony before the naval board of inquiry, the engine telegraph in the control rooms registered "ahead, both engines." Evidently, this was the last order from the commanding officer to the engine room. But the clutch to the starboard engine had been thrown three-quarters out and that of the port engine entirely out. The throttle was in "stop" position and the air throttle "cracked," or barely open, as if one of the engine room squad had tried to shut off the air when he was caught by the water. All this is held to indicate that the crew tried to avert disaster without waiting for orders from the bridge. The rudder was turned hard to right, showing that an attempt had been made to swing away from the "City of Rome." Watertight doors separate the five compartments of the submarine but, apparently, the water rushed in so fast that the men did not have time to close them. Bodies were found in all compartments. That the crew died at their posts of duty was also indicated. The body of Lieut F. D. Foster was found in the engine room with his hand extended toward one of the control valves. James Marlow Schofield, the radio operator, died with his earphones on his head and his hands on his instruments. The disaster claimed the lives of thirty-three of the crew of thirty-six. Seventeen bodies were found in the hull when it was taken to the drydock in the New York navy yard. Raising the submarine was one of the most difficult tasks ever attempted by the navy.

¶Thirty years will be required for the restoration of Rheims cathedral.

DRAIN EVERGLADES FOR PLANTING RUBBER?

Can Florida's millions of Everglade acres be dried up and planted to rubber trees and garden crops? The problem is said to be under consideration by federal reclamation experts, and a survey to determine the engineering requirements of such an undertaking has been authorized, it is reported. The first step necessary would be to lower the waters of Lake Okeechobee to a level where they would not overflow the southern banks and flood the territory. The second would be to drain off the heavy rainfall on the Everglades themselves. Canals already have lowered the lake about five feet. To lead off the rain, which averages from fifty-five to sixty-five inches a year and often falls in torrential downpours, would require large canals. One already dug is twenty-five miles long, 200 feet wide and varies in depth from fourteen to thirty feet. Much of the land in the Everglades is exceedingly rich, so that some of the experts believe that it would produce sufficient return in garden crops to pay for much of the reclamation work in a year or two.

© Henry Miller

Riding Swaying Log in Scene from Motion Picture; Actor Supported Most of His Weight with Hands

RIDING LOG OVER DEEP CHASM AFFORDS MOVIE THRILL

One of the high lights in a sensational scene from a German motion picture was gained by having the hero, while clinging to a log, ride across a deep canyon. The swaying of the cable above and the yawning chasm below made the feat appear sufficiently risky to give the audience the thrill desired by the producers.

INDEPENDENCE HALL MODELED IN SUGAR

Fashioned entirely of sugar and without molds or reinforcement, a replica of Independence Hall has been prepared from an old woodcut of 1781, for exhibition at the sesquicentennial exposition in Philadelphia. The artist is said to have completed it in the short time of twenty hours.

Putting Finishing Touches on Sugar Model of Independence Hall; It Was Copied from Old Woodcut

¶Salts contained in the ocean, if removed and spread over the United States, would make a layer more than a mile and a half deep, it is estimated.

What is Your Pet

IF you got up on the morning of Friday the thirteenth, broke the mirror while dressing, spilled the salt at breakfast, opened your umbrella in the house and walked under the painter's ladder when going to work, would you have an unlucky day?

Probably.

And not because any of those things in themselves are harmful. But anyone who performed that particular combination, or any part of it, hardly would be in proper mental and physical condition to have a very successful day. Breaking the mirror and spilling the salt are apt to be indications of bad nerves, which aren't conducive to a lucky day. Absent-mindedly opening an umbrella in the house where it may swipe the bric-a-brac off the tables and knock the pictures off the walls, or walking under the painter's ladder at the risk of being crowned by a carelessly dropped bucket, both indicate that you may, in equal absent-mindedness, walk in front of a street car or automobile or perform some such other unlucky stunt later in the day.

Mask and Costume Used in Tibetan Mystery Play from Collection of Field Museum

So you see there really is something to your superstitions, after all.

Many of the commonest superstitions are well grounded in fact, even though the fact is not apparent on the surface. Children who disturb grouchy elders by singing early in the morning are told that one who sings before breakfast will cry before night. As there usually is a certain amount of singing and a certain amount of crying in a child's day, it is pretty safe to say that, if the day starts with one, the other will come along in due course. And if a particularly grouchy person is awakened by early-morning song, the crying is apt to come before breakfast too!

The superstition often impressed on children that whistling or singing at the table is unlucky has the same well-founded basis in fact, as children often learn when they persist in the practice.

Gamblers believe that the person who lends money, during play, to a fellow player, will be unlucky, and the borrower will be lucky. Inasmuch as the lender has decreased his available capital, and therefore limited his chances, and the borrower is playing on borrowed money, with consequent increase of his chances, the belief seems quite well grounded.

The reason for many commonly held ideas, however, is not so easily found. Some of them go back thousands of years into prehistoric times, coming down to us, often in corrupted forms, as the remnants of ancient and forgotten religions. The black-cat superstition is a direct descendant of the days when the cat was worshiped in Egypt.

Superstition?

Good-Luck Rings from Many Lands; for Centuries, the Finger Ornament Has Been Associated with a Wide Range of Mystic Influences

Some years ago the swastika swept the country as a lucky emblem. As a basic form of design, it was known in the Orient thousands of years ago, and recent excavations have disclosed that it was similarly used as a religious ornament by the Mayas and the Incas of Central and South America hundreds of years before Columbus discovered America. As a lucky emblem, it was based on Oriental legends where it has played a part in religious worship for centuries.

The swastika and the black-cat pin, and scores of other lucky emblems, went their way in due course, and along came the "Good Fairy." Rotary clubs and business organizations helped distribute the charming little statuette and advised their members to keep one on the desk to bring good luck. Quite probably many of them did, for just to look at the graceful child figure was enough to put one in a good mood, which is the first essential toward a good day.

The superstitions attached to numbers are not so easily explained. Seven has been a lucky number from remotest times, just as thirteen has had a reputation for being unlucky. The favor shown seven is easily traced to its Biblical connections, the world, according to Genesis, having been made in seven days, while the number reappears repeatedly in the visions John saw on the isle of Patmos. The bad luck attached to thirteen may possibly date from the Last Supper, when Christ and the twelve disciples formed thirteen at the table.

Why Friday should be an unlucky day on which to start a journey is hard to see in these days of modern transportation, but in olden days when stagecoaches did not run on Sunday it quite possibly meant that many Friday journeys were broken by the week-end halt away from home.

A horseshoe nailed over the door certainly isn't unlucky, so long as it remains in place, and might bring decided ill luck if it fell while someone was passing beneath, but it is probable that the horseshoe myth has a very simple explanation. An old shoe, studded with rusty nails, and left lying on the ground, might be very unlucky for one stepping on it, whereas if everyone was convinced that to nail it up brought luck, the danger of lockjaw from a nail puncture would be definitely removed.

But can anyone explain why the wishbone of a fowl should be a harbinger of luck, or why a wish made while breaking a wishbone would be granted the holder

Auto-Radiator Cap Combining Several Luck Symbols, Horseshoe, Four-Leaf Clover, Swastika, Wishbone and Black Cat; Examining the 183-Carat Sultana Diamond, Which Is Reputed to Carry Misfortune to Anyone Who Owns It; an East Indian Charm with Movable Features; If Both Eyes and Tongue Protrude When the Owner Grasps the Piece in the Morning It Is Considered a Good Omen

of the larger piece? The luck supposedly attached to four-leaf clovers is an equal mystery, probably going back to a religious symbolism that may be as old as the swastika story or the cats of the Nile.

One of the most modern luck systems, which sprang into prominence during the war, is the chain letter, supposed to go three times around the world, in some versions, and in others to be duplicated and sent to nine or ten friends, who in turn send copies to as many more, until, if all carried out the behest, the postage bill would pay off all the world's debts. The chain letter probably started as a diversion to interest the soldiers thousands of miles from home, but the names that have been attached to some of them in their wanderings form a surprising commentary on the reluctance of even the world's most brilliant people to risk a possible run of bad luck.

Sailors probably hold more than their share of superstitions, some inexplicable to a landsman, and others easily traced to their source. One of the oldest and most general is that it is very, very unlucky to whistle on shipboard—in fact, in the navy, it is forbidden. Since no crusty old merchant captain or salty admiral of the line likes to have his nap spoiled by unseemly sounds from the crew, it is quite easy to see how the myth of bad luck attached itself to whistling.

A few years ago a navy officer, detailed as governor of a Pacific island possession, decided that, since the navy ruled the land, ship rules should apply, and he forbade whistling at any place in his island domain. As a sequel two whistling marines deserted and sailed for Japan in a native boat and nearly died before they were rescued at sea. The story leaked out, a court of inquiry was ordered and the officer killed himself to escape court martial. That is the only case on

Kissing the Blarney Stone for Success in Marriage and the Gift of Eloquence; Irene Bordoni Throws a Pinch of Salt over Her Left Shoulder, a Rite Supposed to Ward Off Ill Fortune When the Cellar Is Tipped Over; at Left, Shoes on the Newly-Weds' Auto for Good Luck

Starting a Journey on Friday Means a Disastrous Ending, So Some Believe; Seeking Beauty by Bathing Hands in Dew at Sunrise

Lower Left and Center Photos © Keystone

record where not whistling was unlucky

The practice of christening ships by breaking a bottle of champagne (before prohibition) or something else over the prow as the boat starts down the ways dates back to the days when libations to the gods of Tyre, Sidon, Carthage, and, later, Rome were poured over a newly built vessel. Sailors believe that if the sponsor is inept and fails to break the bottle the ship will be pursued by bad luck.

The belief that a person falling from a great height died a merciful death by losing consciousness because of the rapidity of his fall persisted for centuries until, only a year or so ago, airmen finally exploded it by deliberately falling 1,500 feet and more before opening their parachutes —and retained consciousness all the way. An equally old belief, with no more basis in fact, is that a person drowning or falling sees his whole past life sweep before him in a mental picture. As a matter of fact, some persons who have gone down two or three times in the water and then been fished out and revived, report they did review their past, while others insist they were busy thinking about the possibility of a future.

CENTER LINE ON AUTO ROAD PROLONGS ITS LIFE

Paved auto roads with a line painted down the center last longer than those not so marked, according to George F. Schlesinger, Ohio highway director. He explains that motorists do not go too close to the edge of the macadam or other paving when the line is present, as they feel safer in driving near the mark. This reduces the breakage on the sides.

© Keystone View Co.

Will Opening the Umbrella in the House Bring Misfortune? Alice Brady Defies the Old Superstition

Even Skeptics Admit Horseshoe over Door Is Harmless if Securely Fastened; Broken Mirror, to Others, Spells Bad Luck

WIND RESISTANCE IN MOTORING

That the velocity of the wind makes a material difference in the speed of his car is realized by every motorist, but just what the resistance amounts to is not a matter of common knowledge. The increase in resistance is not in direct proportion to the increase in the velocity of the wind. For example, a wind of fifty miles an hour exerts a pressure of ten pounds against each square foot of surface directly in its path, while if the wind velocity doubles or the body moves through the air at a speed of 100 miles an hour, it meets with a resistance of forty pounds per square foot. To travel at fifty miles an hour against a head wind of equal velocity, sets up a total resistance to the movement of the car of about 1,000 pounds. At this speed, the total pressure exerted against a man of ordinary size would be equal to a 200-pound weight distributed over the upper half of the body, and it may be conceived that breathing under such conditions is rather difficult.

The Monument at St. Nazaire, France, Marking the Landing Place of the First American Units during the World War

LANDING PLACE OF U. S. TROOPS MARKED BY MONUMENT

To commemorate the landing of the first American soldiers at St. Nazaire, France, June 26, 1917, a bronze monument, costing $100,000, has been erected on the shore of the bay. It is the work of Mrs. Harry Payne Whitney. Funds for the memorial were raised by subscription.

SHOE POLISHER FITS IN POCKET AND CARRIES CLOTHES BRUSH

Shoe polisher and clothes brush have been combined in a compact outfit that can be folded up and carried in the pocket. The shining material is wool sheepskin on a leather back and the brush slips into a small open bracket attached to the polisher.

PLANE BEATS CARRIER PIGEONS IN FIFTY-MILE RACE

Bird wings were beaten by the man-made variety in a race between three carrier pigeons and an airplane from Hammondsport to Auburn, N. Y. The plane won by three minutes and had about sixteen miles farther to go than did the pigeons. The fastest bird covered the distance, fifty miles, in fifty-one minutes.

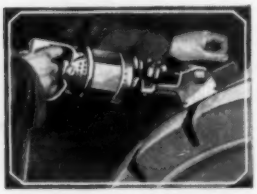
Where a Cartoon Inspired an Architect; Unique Barrel Home Built for William Donahey, the Artist; It Has Accommodations for a Whole Family and Is Decorated with Tiny Human Figures

SUMMER HOME LIKE BARREL HOLDS SIX PERSONS

Adopting an idea from William Donahey's cartoons, officials of a cooperage company constructed a unique vacation home in the shape of a barrel for the artist. Measured in liquid capacity, it would hold 21,000 gallons, but was built as a comfortable house to live in with a main room twelve feet in diameter on the first "floor" and sleeping quarters, reached by a spiral stairway, above. A pantry is also provided, and another barrel serves as a kitchen. Children dressed to represent dwarf characters created by Mr. Donahey helped make the presentation.

DRILL REGROOVES TRUCK TIRES TO PROLONG THEIR LIFE

When the tread on solid truck tires has worn down, new grooves are quickly made with a portable cutter operated by a motor-driven drill. The knife is V-shaped, giving the desired form of groove and is so guided that it always cuts to the same depth. Two sizes of blades are furnished, one for a one-half inch slot and the other for three-quarters of an inch.



SMALL LEVER RING ON BOTTLE HELPS REMOVE CAP

Removing the cap is simplified in a bottle that has a ring attachment at the side. Pressing on it pries the top off quickly and with little exertion. To the cap is connected a small tin fork, useful for the camper or picnicker.

POCKET CAMERAS FOR POLICE TO AID WAR ON CRIME

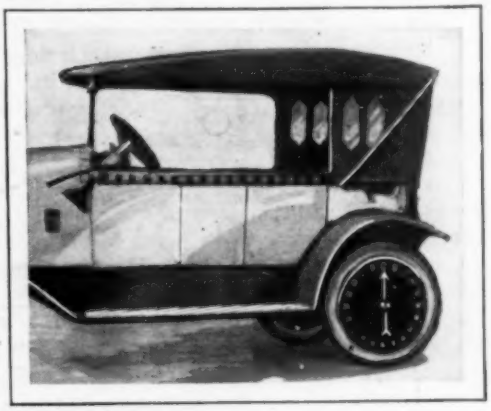
So that photographic evidence of crime and accidents may more easily be obtained, policemen in Cincinnati have been equipped with pocket cameras. They are instructed to take snapshots at the scene, and the films are developed by a special photographer at headquarters.

MAIN CAUSE OF SEASICKNESS LIES IN INNER EAR

Physicians no longer regard seasickness as a mystery and, besides discovering its chief causes, have found ways to relieve it. The trouble, in most cases, has its origin in the well-developed, delicate inner ear, near the seat of the body's balancing apparatus. Infants and deaf persons do not suffer seasickness, indicating that the ear theory is correct. The rolling and dipping of the vessel cause an overstimulation of the nerves in the balancing area and this disturbance in time is communicated to the nerves that lead to the stomach, heart and other organs with the consequent illness. Dr. P. H. Desnoes, a port medical officer, recommends that persons contemplating an ocean voyage observe a few simple rules of hygiene and diet for a week or so before going aboard to avoid serious seasickness. Abundant sleep, horseback riding and swimming are favored and foods with an acid reaction should be avoided, he says. On board, little liquid should be taken at meals but plenty between, only the foods that appeal to the appetite should be eaten, and the mind should be pleasantly occupied.

TAXICAB WITH LOTTERY WHEEL GIVES PATRONS FREE RIDE

Taking advantage of the public's love of gambling, owners of a taxicab company in Montevideo, Uruguay, have painted the left rear disk wheel of their vehicles with numerals from 1 to 20 and fitted a pointer in vertical position to the axle. When a patron hires a cab, he and the driver note the number at which the hand points when the trip is started. If it indicates the same numeral when the destination is reached, there is no charge for the ride. This concern is now said to have a larger patronage than any of its competitors.



Courtesy L'Illustration

Taxicab with Numbered Rear Wheel and Pointer; Passengers Have a Chance of Enjoying Free Rides

Battery and Shocker Exposed on Wearer's Wrist; It Is Intended to Stun an Assailant with Electric Charge

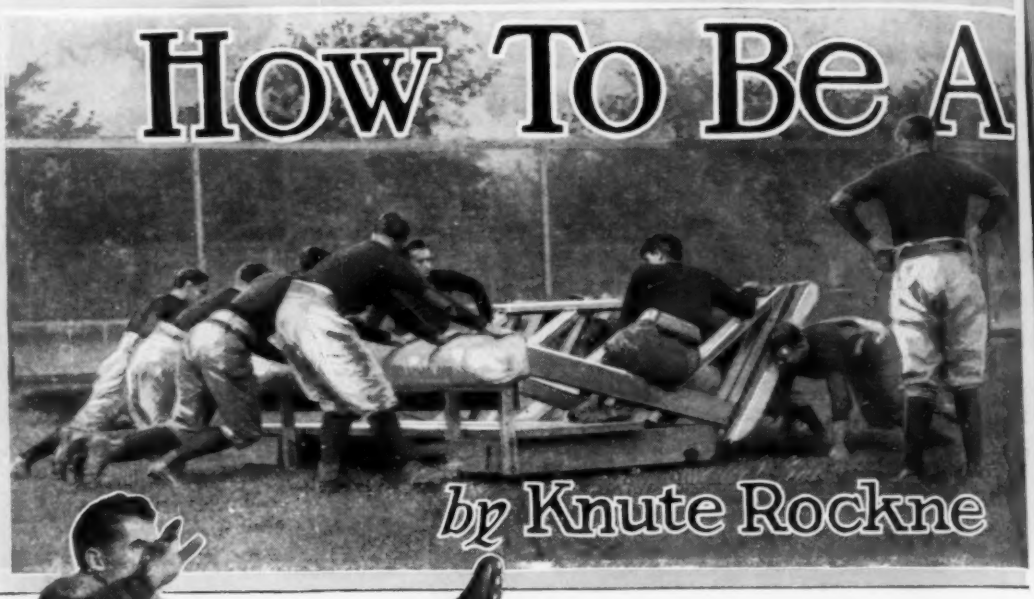
ELECTRIC PROTECTOR ON WRIST DISABLES BANDITS

Worn like an arm band and connected to a battery concealed in the clothing, an electric apparatus devised by a German inventor is intended to protect the wearer from an assailant by temporarily stunning him with a discharge of 10,000 volts. The current is turned on when the guard comes in contact with the attacker.

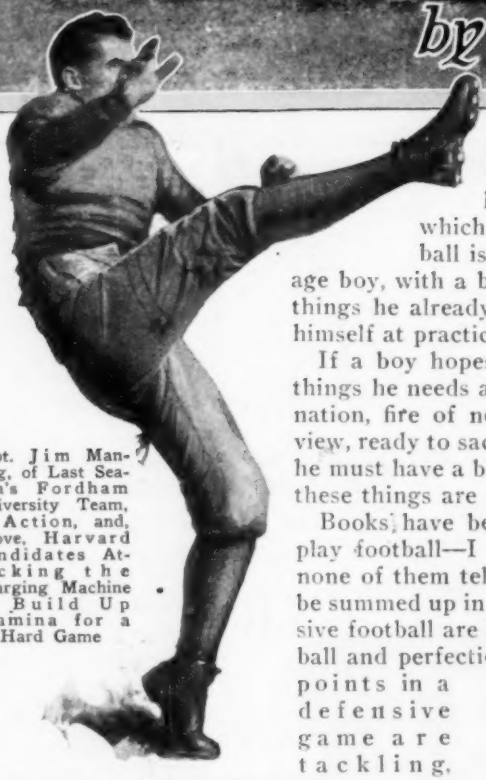
HOT DOG AND BUN ARE BAKED AS ONE IN COOKER

Both the roll and the frankfurter are cooked at the same time in an electric unit designed for installation at lunch counters and soda fountains. The dough is poured into molds, a sausage placed in each and, in about four minutes, both have been baked sufficiently for consumption. Another attachment provides an injector by means of which a dose of mustard may be applied to the sausage.

How To Be A



by Knute Rockne

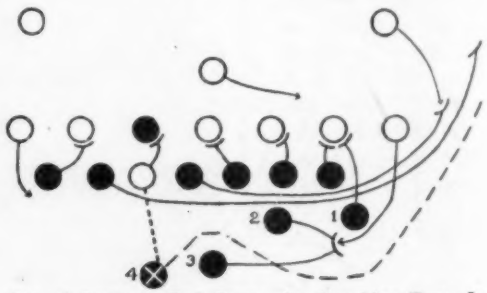


Capt. Jim Manning, of Last Season's Fordham University Team, in Action, and, Above, Harvard Candidates Attacking the Charging Machine to Build Up Stamina for a Hard Game

IT doesn't take an expensive supply of purchased equipment to outfit a boy for high-school or neighborhood football, which is one of the important reasons why football is such a popular game. In fact, the average boy, with a bit of ingenuity and the odds and ends of things he already has, can assemble a complete outfit for himself at practically no expense.

If a boy hopes to be a good football player the main things he needs are brains, courage, self-restraint, co-ordination, fire of nervous energy and an unselfish point of view, ready to sacrifice for the team as a whole. Of course, he must have a bit of speed and a bit of physique, but then these things are taken for granted.

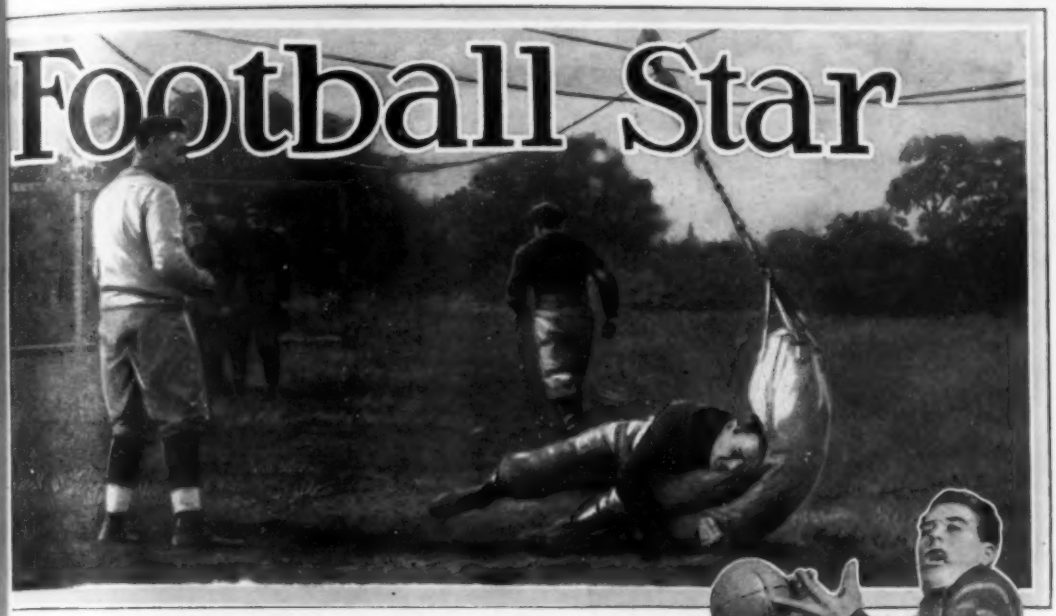
Books have been written by many coaches on how to play football—I have written some of them myself—and none of them tell all the story. Yet, the basic things can be summed up in a very few words. The essentials of offensive football are blocking, interfering, ability to handle the ball and perfection in the execution of details. The main points in a defensive game are tackling, ability to knock down forward passes and to ward off would-be interferers by use of hands and nimbleness of foot. Get eleven boys together who have all or most of these abilities and, with plenty of hard practice and drill, you can whip them into a team that moves like one boy.



One of Rockne's End Runs; the Attacking Team Is Shown in Black, with Center in White, and Defenders in White with Black Center

The one point where the average high-school or neighborhood team is weak,

Football Star



however, is in appreciation of the necessity of hard work and constant drill. It is so much pleasanter to go out and play a game than to spend hours working over tackling, running, signals and other drill points. Without the training, however, there can't be much success in the playing. It isn't enough to master the mechanical details of the game, learn signals and complicated plays. The good team is the one that is able to study the other fellow and beat him by quicker wits. You not only have to know when to do a thing, but when not to do it. Take forward passing, for example. The good quarter back—and the quarter back must run his team—needs to know when to try a forward pass, but more important still, he must know when not to try it.

© U. & U.

Capt. McGrath, of Last Year's Georgetown Team, Catching a High One, and Army Players Tackling the Dummy, Above

A good team will not try to forward pass against a strong wind; it will not forward pass while deep in its own territory, unless it is behind or near the end of the game; it will not forward pass near the opponent's goal line except on fourth down; it will not forward pass when the opposing team is plainly expecting one; nor will it forward pass when it is ahead in the score. In other words, the good quarter back gambles only when he has nothing to lose and everything to gain. When he has everything to gain, as for example when his team is behind, then he resorts to the pass.

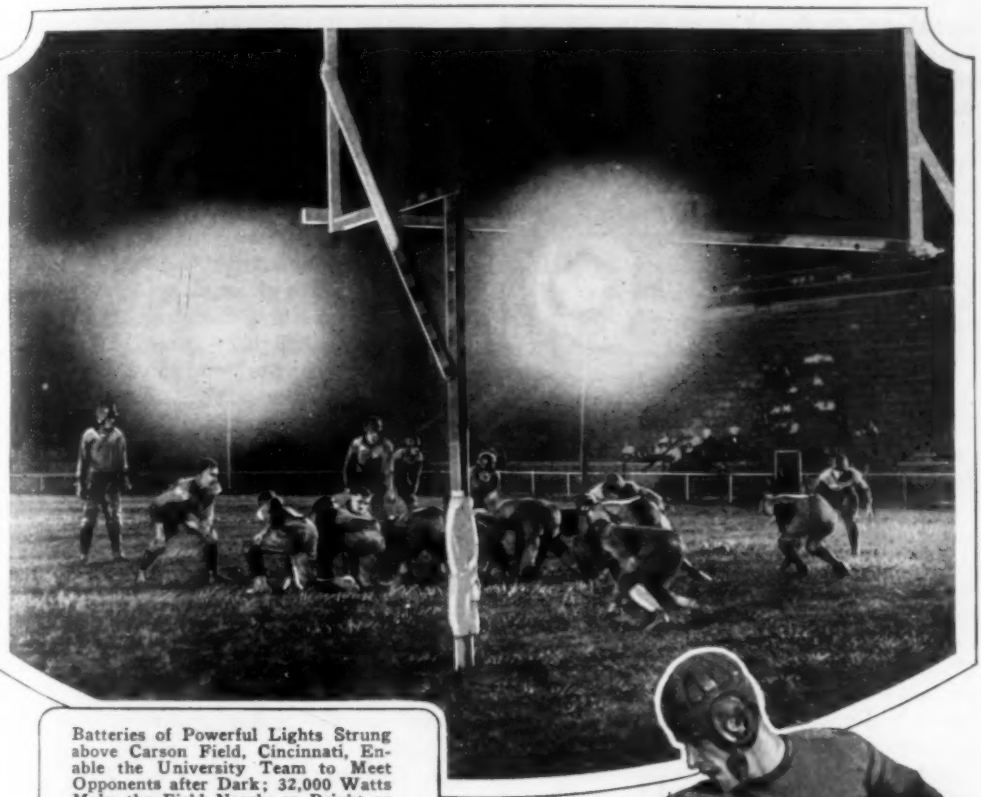
A book of advice for the quarter back alone could easily be written, without telling everything he ought to know. He must have confidence in himself, and have control over his team, so that when he stakes everything on a play there will be no questioning of his judgment. He must bark out his numbers clearly, distinctly and loudly. When in doubt, he must remember that it is always the safest thing to punt.

Knute Rockne, the Coach Who Developed the Famous Four Horsemen of Notre Dame

Plays do not mean as much on offense as the average boy would think. One team will put on some plays that work wonderfully well, and another team will try the same plays and they look terrible. It is all a matter of execution. The quarter back should keep track of the plays that have worked and those that have failed, then drop the latter and push the former. That is one of the big things emphasized in any book on football tactics and strategy.

Getting back to homemade equipment, though, how many boys know that they don't need a special pair of football shoes, special football pants, shoulder guards or a helmet? You can make a very serviceable pair of football shoes out of any old pair of everyday ones by simply nailing on a set of fiber cleats, which can be obtained cheaply from a sporting-goods dealer or the maker. A pair of swimming trunks seems a queer thing to include in a football outfit, but if you sew a pair of fiber thigh guards to them, don the trunks and put on an old pair of khaki trousers over them you have all the leg protection you need, as shin guards are no longer in fashion. Cheap cotton hose and jerseys don't cost much, and on the shoulders of the jersey you can sew in some horsehair padding, such as you will find in an old buggy or automobile seat, and have good shoulder protection. You may be surprised to know that a headgear is not necessary, and that quite a few college players have never worn one, yet have never received a head injury. The headgear serves chiefly to protect the ears, and if you feel that you must have one, buy the cheapest you can get. Nose guards, like shin guards, are obsolete.

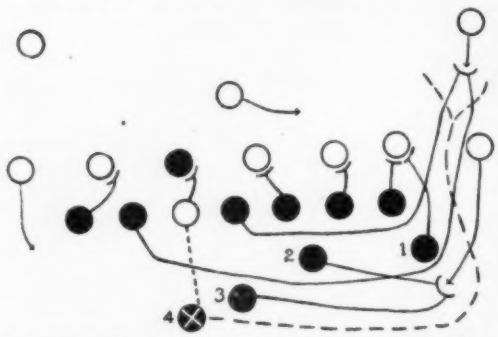
I haven't much to say on what a boy should eat, as the old-fashioned ideas on strict training are also becoming passe. Of course, a boy should absolutely abstain from stimulants (even coffee must be taboo) smoking and poisons, such as alcohol, but if he eats at home the fine home cooking which his mother prepares is good food for any football player. There are just a few things he ought to stay away from. They are chocolate, cocoa, chocolate candy, greasy fried potatoes, pork and bananas. These things are all hard to digest and the average boy will



Batteries of Powerful Lights Strung above Carson Field, Cincinnati, Enable the University Team to Meet Opponents after Dark; 32,000 Watts Make the Field Nearly as Bright as Day; Below, Chester Bowman, Olympic Star Runner, Is Shown Bucking the Shoulder Straps in Practice for the Syracuse Team

George Wilson, Captain and Star Half Back of Last Season's West Coast Champions, the University of Washington, Shown Carrying the Ball

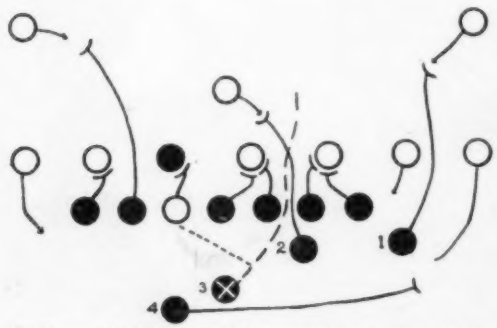
find that they do not agree with him when he is playing football. Boys should eat regularly, three times a day, and must not eat between meals. The meal before a



An Off Tackle Play Designed by Rockne; Note the Back Four, with the Ball, Has Two Routes Open

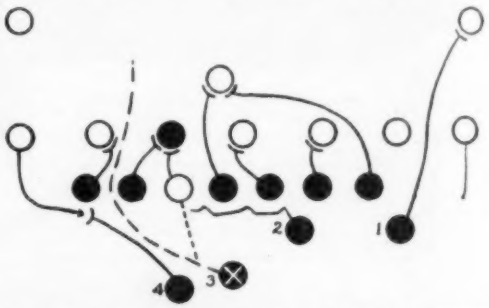
game, however, must be very light. This is important. The boys should not eat when they are tired. They should not drink ice water before a meal. If a boy bears these few things in mind, he will find that, as far as the stomach is concerned, he will feel fit for the game. Boys should go to bed every night around ten o'clock and should get at least nine hours' sleep. They should not take the game too seriously but should try to get as much fun out of it as possible. Do not try to play, if you are hurt, and be sure to have all injuries treated by a competent physician. Towels applied as hot as you can stand them will be found a great relief to most bumps and bruises. However, don't be a mollycoddle—remember that football is supposed to bring out the Spartan in the young boy, which means to make as little out of an injury as possible, not losing, however, the common-sense point of view.

The proper way to tackle a man is to



A Plunge in Which Back Four Fakes as Though He Had Ball, While Two Clears Way for Three

crouch down low with the weight well forward, head back and eyes open and knees well bent. Keep your eyes on the man you are tackling, particularly his hips, drive at him with all the power of your legs and hit him squarely with the shoulders and the instant the shoulder lands, wrap your arms around him and pull the arms toward you as hard as you can, still shoving through with the shoulders, and take one or two short, digging steps. This will throw the ball carrier back in the direction from which he came. It stands to reason that if you knock him off his feet he cannot go any farther. The high spots of tackling, however, are lots of leg drive, eyes open, and using good judgment in timing and distance. Sometimes, when the ball carrier is far to one side, the tackler will have to leave his feet and throw his body in front of the ball carrier, wrapping his arms around him as he does so. This will cause the ball carrier to fall over



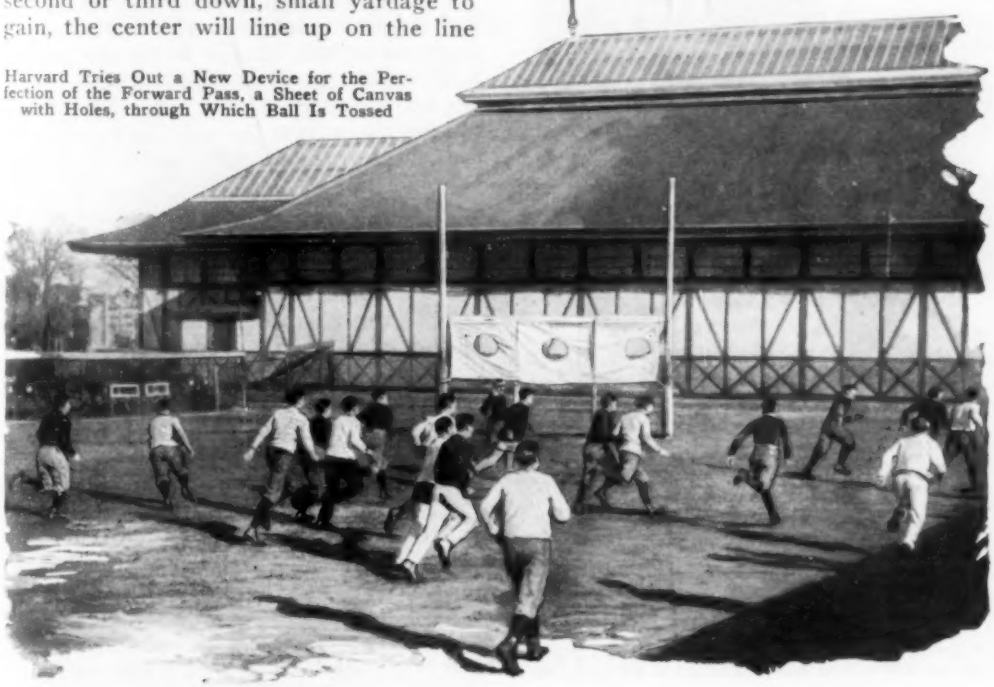
A Weak Side Play in Which a Hole Is Opened through Which Back Three Plunges with the Ball

the body of the tackler, as he is obstructed by his body and cannot get away, having the tackler's both arms wrapped about him.

Blocking is the means used by an offensive player to keep a defensive player from the ball carrier. Interference is collective blocking. In the line, there are two methods of blocking generally used. If the opening of a hole is intended, the offensive lineman charges into his opponent, hitting him a little bit above the knee, using short, digging steps, with lots of leg drive. The legs should be well straddled, tail low, head back and eyes open and you should stick to your man as long as you can. If, however, you are merely blocking him to prevent him from getting through to hurry the passer or to hurry the kicker and it is not necessary to make a hole,

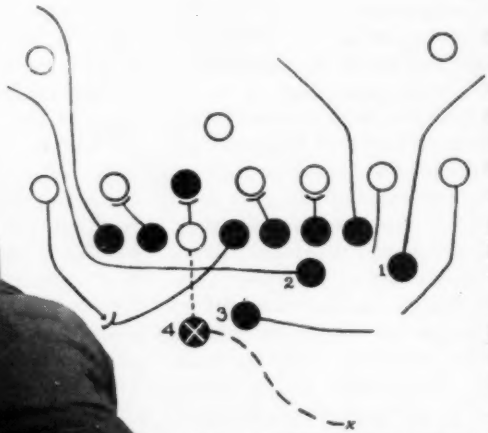
then the offensive lineman merely slaps his hip in the opponent, getting the head and arms beyond him and using all the length of his body as a blocking surface. Do not go so low that the defensive man can jump over you. These two types of blocking, of course, are used against stationary players. Out in the open, the block to use against a running opponent is what is known as the cartwheel. This means to throw your body horizontally at your opponent very much the same as the diving tackle, only you do not use your arms. You hit him with your hips or side and keep on rolling. Get plenty of leg drive and be sure to dive through the man, not merely in front of him.

The points to remember on defense are that the guards, tackles and ends must charge through their own territory as if expecting the play to come over their hole. The defensive center is allowed certain liberties and may be in the line charging. He may drop back three yards or he may be in the line non-committal, ready to charge or pull out, depending on what kind of play comes along. If the other team has first down ten, the defensive center will be in the line but ready to pull out to help tackle on the flanks. If it is second or third down, small yardage to gain, the center will line up on the line and charge through. If it is second or third down, many yards to gain, the defensive center can drop back several yards to a position where he can best defend against that which under the conditions he has every right to expect—a forward pass or a trick play. If the opponents have a formation where the quarter back receives the ball from the center, the defensive center will be in the line charging. If the other team, however, is using the direct pass to the ball carrier, then the defensive center can be in the line ready to pull out or he can drop back several yards. The man backing up the line is responsible for line plunges and end runs. When the other team has second or third down, many yards to gain, he should be more alert for forward passes and may drop back several yards. The half backs are responsible mostly for forward passes. The man playing safety on defense will have to be a good punt catcher and can also help defend against long forward passes. On defense, every boy should take it upon himself to do everything in his power to stop the play that the opponents put on, but above all, he must use his hands, be shifty on his feet and use his eyes. See everything.



Harvard Tries Out a New Device for the Perfection of the Forward Pass, a Sheet of Canvas with Holes, through Which Ball Is Tossed

Red Grange, the Wheaton Iceman and Greatest Player of Recent Years, Who Made a Fortune in a Few Weeks



One of Rockne's Many Forward Passes, Used by the Famous Four Horsemen

One of the things the quarter back must learn is that, if a punt looks as though it would roll for touch back, he should not try to catch it. Close to his own goal line, he should kick on first down unless he intends to play for position. When near the sides lines, it is always best to run a play for position. The quarter back should keep his eyes open and watch for weak spots in the opposing team, and when he finds one not forget it. Against a strong defensive team, kick, kick and keep on kicking. On a wet and muddy field, kick and let the other fellows take the chances of fumbling the ball. Always be sure that every man on the team is ready before you call a play. Usually you will find it best to charge on the next number after the signal, instead of on the signal itself. That gives the boys a second to get set for their specific job. Maneuver to keep away from the side lines and near the center of the field as much as possible. Watch who makes a tackle and it may suggest a play to you. Use punt formations deep in your own territory and save your close attack until after you get past the middle of the field. Stall when you are playing against the wind, and speed up the game when you have the wind behind you. Likewise stall when you are ahead or when your team is tired, and speed up when you are behind or when the eleven are hitting on all cylinders. Save your best forward-pass plays for the second half. If you have a weak kicker you can try a long forward pass in your own territory. Against a team which has a powerful offense, hold the ball as long as you can.

Don't try to handle a kicked punt which is rolling uncertainly, and when you are

catching a punt and you see the opponents have their ends right on top of you, signal for a fair catch. Be sure that you are able to tackle in the open, but, if you can maneuver a ball carrier toward the side lines, do it.

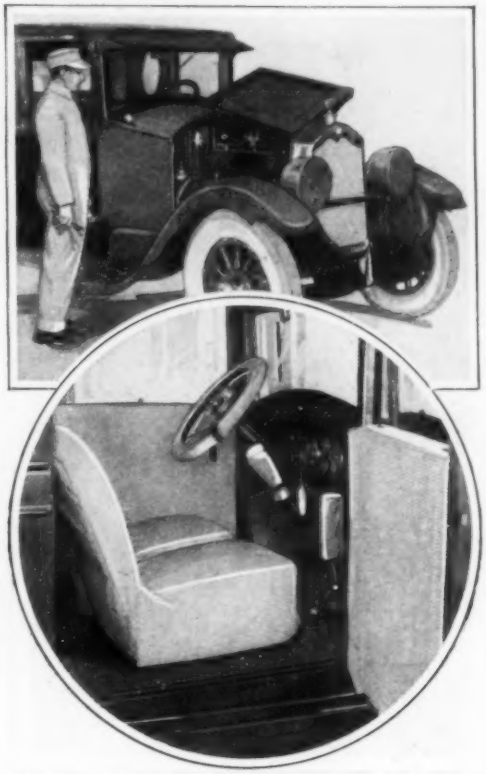
In offensive territory, use your best play on first down. By best play I mean the one that has proved the biggest ground gainer. Try a trick play or a long ground gainer whenever you have recovered a fumble, as you will then catch the defensive team up in the air. When the defensive line tightens, use end runs, and when they spread out, use line plunges.

FLAMES HELP DEAF CHILDREN LEARN HOW TO TALK

Sensitive gas flames that dip and sway when vibrations of the voice come in contact with them are used by an English instructor to help teach deaf children speech. The little tongues of flame shoot up through hollow tubes and can be regulated as desired. They give the child a visual picture of his voice as a substitute for the sound impression received by the person of normal hearing. For example, certain vowel sounds cause the flame to dip sharply such as the "ar" in carpenter and the "a" in table. By stationing the child farther away from the flames, he learns to speak louder and develop his voice.

© Photopress

Deaf Children Learning to Talk with the Aid of Sensitive Gas Flames, Which Move with the Voice Vibrations



Covers on Seats, Door, Wheel and Clutch, and Above, over Fenders, Cowl and Hood

FABRIC COVERS PROTECT AUTO WHILE BEING REPAIRED

Stains are kept from the auto upholstery, and fenders, cowl and hood are protected against scratches while the car is being repaired, by fabric covers quickly slipped over the parts most likely to be damaged. It is said that the entire set can be adjusted in less than three minutes. The durable fabric can be washed without shrinking and the shields are made in various sizes to fit almost all makes and models of cars. Covers for the seats are intended to be left in place, if desired. They fit snugly and are attractive.

¶In the language of the sea, a ship's carpenter is commonly known as "Chips."

Comic Face on "Slicker"; It Changes Expression as Garment Wrinkles and Has Movable Eyes

ANIMATED FACES ON "SLICKERS" LATEST FASHION NOVELTY

With almost every movement of the wearer, faces painted on slickers with waterproof paints, change expression, for the eyes, lashes and lips are inclosed in celluloid compartments and are movable. Animal designs are also devised in the same way, and for those who desire something distinctive, a skull pattern is provided.

DESK MEMORANDUM ON ROLLER ECONOMIZES PAPER

Paper is supplied as needed for making notes from a roller pad placed on the desk. A strip, four and one-half inches wide, is carried on a pivoted reel on top of the holder and is unwound by turning a milled-head screw. At the upper end of the pad is a metal straightedge for tearing off pieces to be filed away.

PEDALING PLAYER PIANO AIDS TREATMENT OF FEET

Operating a mechanical piano in stockinged or bare feet is recommended by an eastern physician to help strengthen the foot muscles and to relieve arch troubles and other ailments. Besides the exercise of pumping the pedals, the music takes the patient's mind from his pain, the doctor asserts, and he believes the response of the muscles to the vibrations of the instrument exerts a beneficial effect. The player-piano method is superior to dancing or operating a bicycle, the physician declares. The importance of proper care of the feet is now widely recognized, and most doctors agree that many ailments can be traced to their abuse. It is said that ninety per cent of all foot afflictions are caused by improperly fitted shoes.

SHADE FOR AUTO HEADLIGHTS KEEPS RAYS ON ROAD

The principle of the eyeshade has been adapted to automobile headlights in a metal shield that fits over the bulb and can be adjusted to keep the rays of the lamps on the road instead of shining into the eyes of approaching drivers. The deflector is made to fit on any standard light and is quickly put on underneath the outer rim of the lamp. It may be bent or turned to any desired angle.

STAINLESS STOCKINGS

Waterproof imitation-silk stockings that are not stained by mud splashes have appeared and are available in any shade desired. A method has also been devised for giving the material the dull sheen characteristic of genuine silk instead of the bright luster of the artificial product.

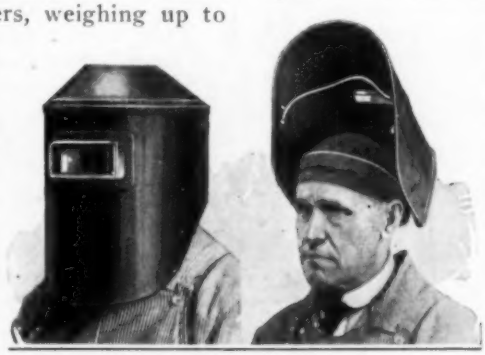
COSTLY GARDEN BUILT IN TERRACES ON HILLSIDE

Terraced Garden on the Grounds of a Private Estate in California; Tinted Sandstone Walls to Support the Steps Produce Pleasing Color Combinations, and the Different Levels Are Connected by Stairways

What is believed to be the world's costliest private vegetable garden is being completed in southern California. It is of the "hanging" or terraced type, comprises one acre of level land, and represents an expenditure of $75,000. The owner's estate is on the high hills, and the only spot available was an amphitheater-like slope, which has been converted into an extraordinary garden. Employing a beautifully tinted sandstone, a series of gracefully curved walls, aggregating more than a mile and a quarter in length, was built to form the terraces. Embodied therein are numerous bowlders, weighing up to a ton and a half each and requiring hand hoists for placing. The average height of these supports is four and a quarter feet, though some rise eighteen or twenty. The soil surface on the terraces is from six to ten feet wide and averages eight. All are connected by three-foot stone stairways, each of the lower tiers having four, and these steps zigzag and fit in so admirably that they are not readily detected at first glance. In the middle section, they assume the character of stone ladders. The terraces have an easy grade from north to south and are watered by a gravity irrigation system.

HINGE TOP ON SAFETY HELMET ADDS TO WEARER'S COMFORT

Provided with a front section that tips up over the head on hinges, a safety helmet for workers does not have to be removed, when not in use as a protector, and can be closed quickly in case of an emergency. When raised, the movable part stays up out of the way of its own accord and fits snugly, yet not uncomfortably, well down on the neck and chest, when lowered.



Helmet Closed, Showing Window, and Top Tipped Back; a Soft Headpiece Protects the Scalp

The Magic Lure of Ciphers

Secret Writing Has Saved Scholars' Necks and Won Wars; How Mystery Messages Are Formed and Solved

By PAUL PADDOCK

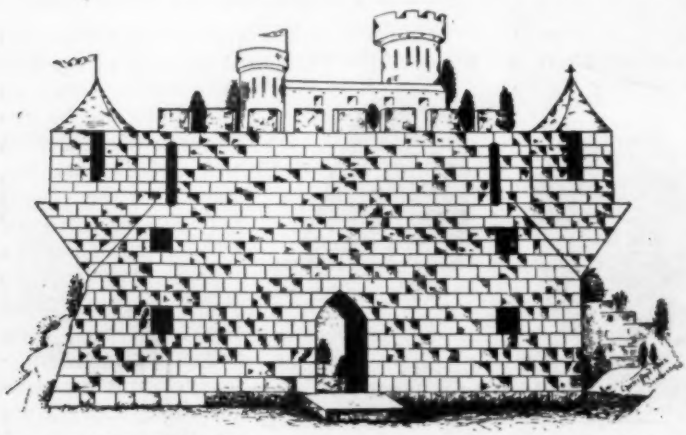
IF you should lose your pocketbook while traveling abroad, the single word "sooty," cabled home, would tell the folks that you were in need of funds. And if you received the word "stall" in reply, you would have a right to feel disappointed, for it would mean, "no more money will be sent." If the business man wants to be kept posted on affairs while in foreign countries, the brief message "otter" will order his firm to "keep me well informed as to business. If anything important occurs, do not fail to wire me."

The foregoing expressions are taken from a travelers' code system of some 2,000 terms, each of which stands for a whole message. Many firms and individuals have their own systems of secret communication by telegraph, cable and radio, and at Washington, a number of experts in the department of justice and in the signal corps of the army are constantly at work, revising and translating codes and ciphers that carry important state and military secrets in peace times as well as in war. The dot-and-dash signals that sometimes interrupt your radio programs, crossword puzzles, writing for the blind and shorthand are also forms of this art of cryptography, or secret writing, one of the oldest and most difficult sciences known to man.

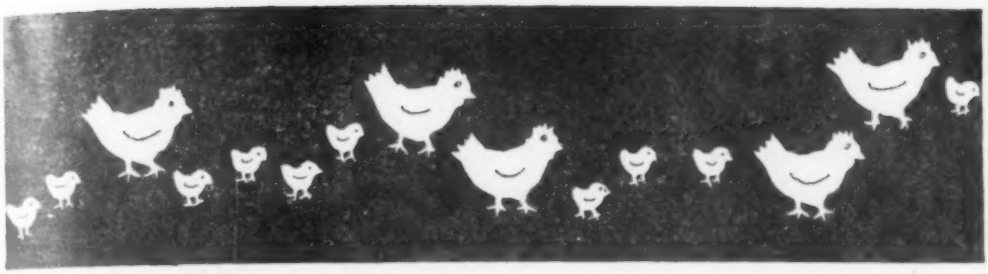
Discussing this science, Edgar Allen Poe once declared, "it may roundly be asserted that human ingenuity cannot concoct a cipher which human ingenuity cannot solve." He partly substantiated his position by deciphering scores of complex codes sent to him for tests. But it is not necessary to go back to the author of "The Gold Bug" for proof of the statement. The Riverbank laboratories, near Geneva, Ill., for more than thirty years, have been demonstrating that Poe was entirely right.

Calling on Col. George Fabyan, founder of the institution, for a glimpse into this fascinating world of hidden meanings, you step into one of the most remarkable libraries in the world. Here, among first editions of Shakespeare and hundreds of other rare old volumes, are some 39,000 different ciphers. Years ago, Col. Fabyan became interested in the subject of cryptograms while seeking a secret code for use in his business. To satisfy his curiosity, he scoured the world for books relating to ciphers.

After a few moments' talk with Col. Fabyan you learn that cryptography probably originated several centuries before Christ, very likely under the direction of the famed Assyrian queen, Semiramis. At any rate, one of the earliest examples of cryptography is found on her tomb. Some 700 years after it was inscribed there, an expert laboriously deciphered it, and this was the reward for his labor: "O poor miserable slave of deciphering that thou art, from this time on, occupy thyself with more



Even a Brick Wall May Tell a Story in Cipher; White and Shaded Blocks Here Are Arranged to Spell a Short Poem



Another Illustration of the Almost Limitless Possibilities in Cipher Picture Writing; Here, the Hens Represent One Part of the Cipher and the Chicks Another; the Word Is "Egg"

fruitful things than to spend time thus uselessly!"

The Spartan soldiers employed an ingenious cipher system, using strips of parchment wound in a special way around a wooden cylinder. The writing was inscribed longitudinally, the parchment removed and dispatched. The officer who was to receive it had a cylinder exactly like the one on which the strip first had been wound. He wrapped the parchment on his cylinder making the original message clear.

Bacon and other scientists in the time of Queen Elizabeth wrote profusely in cipher for self-protection and secrecy because, at that time, anyone who had scientific knowledge was likely to be suspected of being in league with the devil and to be beheaded.

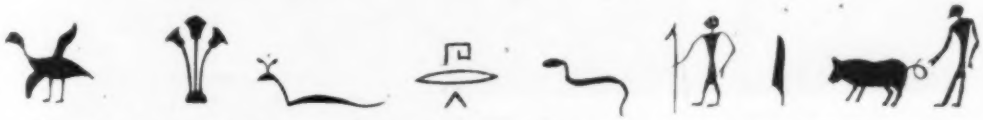
A method of inserting ciphers in books was worked out by using different forms of type, and as the printing was absolutely controlled by the government and all typefounders and printers licensed, heavy penalties were imposed on persons who used printing presses without government permission. Thus it was possible for those having control of printing to insert ciphers in the books for the purpose of recording any information they chose with the idea of having it available for others of the time or for posterity.

"The use of ciphers," Col. Fabyan declares, "seems to go by cycles. About every 300 years, they reach a high point. We have just passed through one such period in the World war. All true ciphers can be grouped into two great classes, transposition and substitution ciphers. Frequently, an expert can tell almost at a glance to which class a particular cipher belongs. In the first class, the letters have been rearranged to conform to some plan; in the substitution cipher, numbers, designs or what not are substituted for the real characters. Suppose you let Miss Cora Jensen here, one of my assistants, show you how a real cipher is tackled."

Miss Jensen led the way to her office, where more bookcases filled with works on ciphers lined the walls. She produced a long sheet of paper, ruled in tiny squares. This jumble of letters, grouped in units of five, was written in pencil:

LXFZI QCTAM PCSPT RFZIQ SPLOL
RFZIQ GFASP TGTCP OFCTR FZIQS
PLBTH TVSPX LAMTR MTGRP FOAFZ
RMLGN ETCLX FZIQC TAMPC SPTMT
BSPPG AMTGT HLNMA MTYPS PPGSV
OTCOF CTMLN MAMTY PSPPG MTBGP
YPCPS PGSZA TMTBX TBFGR PTGTC P

"This is what is known as the reversed single-alphabet cipher," Miss Jensen said. "It looks hard but it really isn't. One of the first steps in solving a cipher of this kind is to count the number of times each letter has been used. This is important, for we have discovered, after counting the characters from thousands of pages of many kinds of manuscript and printed text, that, in English, the letters are used in the following order of frequency, e, t, a, o, n, i, s, h, r, d, l, c, u, f, m, p, w, g, y, b, v, k, x, q, j, z. In other words, the vowels



Illustrations of Early Egyptian Picture Writing, Possibly the Beginnings of the Alphabet as We Know It Today; Designs Similar to These Are Sometimes Made into Ciphers for Modern Usage

occur about forty per cent of the time, the consonants l, n, r, s, t, about thirty-five per cent and j, k, q, x, z, less than two per cent. The order varies somewhat in other languages, but the e is always first."

Miss Jensen rapidly wrote the alphabet in a column down the side of a sheet of paper and then put a check after each letter as it occurred in the cipher. Before she had gone very far, it was apparent that the t's, p's and f's were leading, while the a had been used but five times and the e, the most frequently used letter in the alphabet, not at all. Evidently, then p or t, stood for e. To illustrate, Miss Jensen made the substitution, putting down p as the cipher equivalent for e, t for a and other letters as they evidently fitted the frequency guide.

The cipher, with the translation written above it, then looked like this:

IWOUL DRATH ERBEA COULD BEIFI
LXFZI QCTAM PCSPT RFZIQ SPLOL

COULD NOTBE ANARE FORAC OULDB
RFZIQ GFASP TGTCP OFCTR FZIQS

EISAM AYBEW ITHAC HANCE OFTOU
PLBTH TVSPX LAMTR MTGRP FOAFZ

CHING PARIW OULDR ATHER BEAHA
RMLGN ETCLX FZIQC TAMPC SPTMT

SBEEN THANA MIGHT HAVEB EENBY
BSPPG AMTGT HLNMA MTYPS PPGSV

FARFO RAMIG HTHAV EBEEN HASNE
OTCOF CTMLN MAMTY PSPPG MTBGP

VERBE ENBUT AHASW ASONC
YPCSP PGSZA TMTBX TBFGR

EANAR E
PTGTC P

The top line of letters is easily identified as a sequence of properly spelled words with the letters chopped up into groups of five. The translation forms this poem:

I would rather be a could-be,
If I could not be an are,
For a could-be is a may-be
With a chance of touching par.

I would rather be a has-been
Than a might-have-been by far,
For a might-have-been has
never been
But a has was once an are.

The key to this reversed alphabet is as follows. Plain text, a, b, c, d, e, f, g, h, i, j, k, l, m, n, o, p, q, r, s, t, u, v, w, x, y, z; cipher, t, s, r, q, p, o, n, m, l, k, j, i, h, g, f, e, d, c, b, a, z, y, x, w, v, u.

One way to tell the difference

SUBSTITUTION CIPHER

1	2	5	6	2		5	5	6	1	3		1	5	1	2	1
1	2	6	1	3		5	3	6	1	2		4	5	1	5	5
6	3	1	5	1		2	6	2	3	3		5	5	4	4	4

—KEY—

1	2	3	4	5	6	1	2	3	4	5	6
N	O	P	Q	R	S	A	B	C	D	E	F
G	H	I	K	L	M	T	U	W	X	Y	Z
J						V					

The Message in Cipher Above Is "The Surest Way Not to Fail Is to Determine to Succeed." A Glance at the Key Explains the Secret; the Letter Equivalent for Each Number Is Found in the Key Corner That Corresponds to the Arrangement of the Lines Appearing with Each Number

Miss Jensen at One of the Multiple-Alphabet Tables; Different Combinations of Letters Produced on Strips under the Glass

between a transposition cipher and a substitution cipher is to count the occurrence of the vowels. If they constitute forty per cent or so of the text, the decipherer can be fairly sure that the cryptogram is of the transposition class. An aid in working the ciphers is what is known as the polyalphabet, a curious arrangement of little pasteboard strips between plates of glass. Each strip is printed with the alphabet and can be moved up and down to form combinations of letters crosswise to help reveal what characters have been substituted for the real ones.

The use of numbers instead of letters is a common way of writing in ciphers. Another sheet of lined paper was produced with a sequence of numbers. A glance at the key explains it.

The cipher: 11,21,25,12, 14 31,12,24,22,24 31,31,45, 34,11 35,11,24,14,11 25,14, 24,35,15 12,25,35,11,43 13, 14,41,44,45 13,35,12,45,11 31,11,14,35,13 25,11,43,13,14 41,41,13,25,35 15,12,25,25,12 41,26,26.

The key:

	1	2	3	4	5	6
1	a	e	ij	n	r	w
2	b	f	k	o	s	x
3	c	g	l	p	t	y
4	d	h	m	q	uv	z

Solution: "Absence of occupation is not rest; a mind quite vacant is a mind distressed."

By Rotating the Different-Lettered Disks in This Device, Cipher Combinations Are Produced

A German Love Message in Flower Cipher; It Reads, "I Will Remain True to You Until Death"

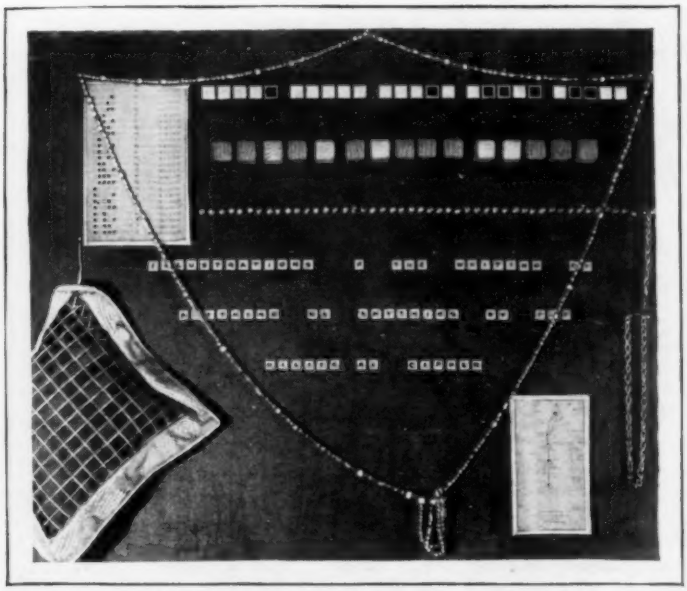
The alternate vertical-transposition cipher is another simple form. As may be seen, it is made by putting the letters down vertically instead of horizontally, in the manner indicated in the key.

The cipher: TEAOO OTNAH ETBHD EEEGF IISRX ASTFR STOIM PSWWT GEOAL EGNCR.

The key: THEFIRSTGR
EATGIFTWEC
ANBESTOWON
OTHERSISAG
OODEXAMPLE

The message is: "The first great gift we can bestow on others is a good example."

While the use of ciphers probably helped some of the writers of old keep out



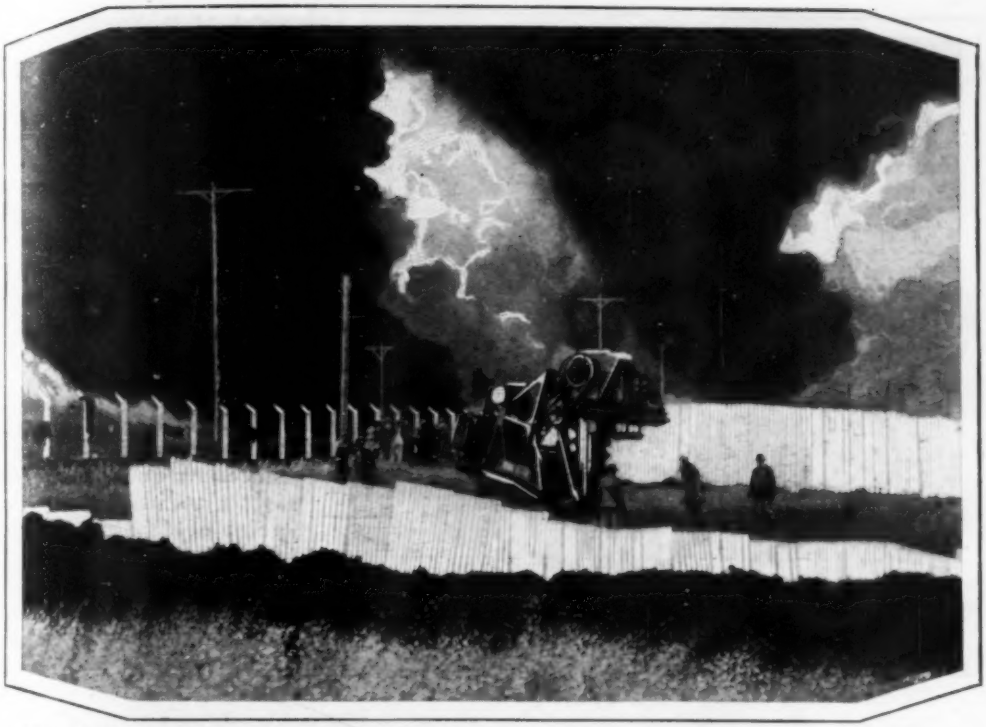
Blocks, Beads, Chain Links and a Pillow-Top Design Arranged in Cipher, Showing That Common Objects May Represent Secrets

of prison, the cryptogram was also an aid in other ways. For instance, when the seventeenth-century lover wanted to "say it with flowers," he sometimes did so literally. The blossoms, prepared as a wreath, apparently were first laid in a row on a table, the different kinds occupying their proper places, either singly or in duplicate. The stems were then tied together with strings and then rolled up, making a circular bouquet, or wreath, like the one illustrated herewith, which is taken from Johannes Balthasar Frederici's "Cryptographia," published in Hamburg in 1685. The design is to be read in clockwise direction beginning at exactly twelve o'clock. The end of a word is indicated by a spray of lilies of the valley. The message reads, "Ich bleibe dir getreu, bis in den tod," which, translated, is, "I will remain true to you until death."

Volumes in Col. Fabyan's library show that many of our modern forms of secret writing are not new at all, but merely modifications of ciphers originated centuries ago. In 1588, for instance, Timothy Bright, "doctor of Phisike," printed one of the first known works on shorthand, and in 1669, Jeremiah Rich published the entire Book of Psalms in shorthand that closely resembles the characters used today. It is a tiny volume, little more than two inches long, half an inch wide and less than that in thickness. Other books show that cipher principles were used in devising one of the first combination locks, similar to those we use today, and in one of the works of Trithemius, sometimes called the "Father of Ciphers," appear illustrations of various forms of the wheel cipher. On the spokes were different arrangements of the alphabet. A revolving guide attached to the center was also printed with the alphabet in normal order. By swinging it around, until the characters on it are opposite to those on the spokes, various equivalents for the letters of the alphabet are obtained.

"Solving ciphers is a process of fitting and trying," said Col. Fabyan. "We worked eight months on one here before we finally got it. There can be only one correct solution so that this really helps matters, although the key is often hard to find. But the cipher expert learns how to find clues and recognize them when he does find them. For instance, the kind of words used give us help. If two or three stories were submitted to us from each of two authors and then another story, written by one of them, were sent in unsigned, we would be able to plot a curve, based on the vocabulary used, so that we could tell which of the two writers was the author of the unsigned manuscript.

"During the war, we had considerable trouble with messages not written in cipher at all, but just jumbles of letters or symbols. But some of the most perplexing cryptograms are simple after all. One that gave us considerable worry proved to be in route cipher. It may be formed in this way: Rule your paper in five columns and put a word in each column, as you write line by line. To make the cipher, simply take the words by columns instead of by lines. Telegrams are frequently sent in this manner."



View of Oil Fire and Barricades Erected to Keep It from Spreading; the Ditch Digger Is Seen in the Center; When Flames Became Too Hot, Operator Jumped Off, Allowing Ditcher to Run near Blaze

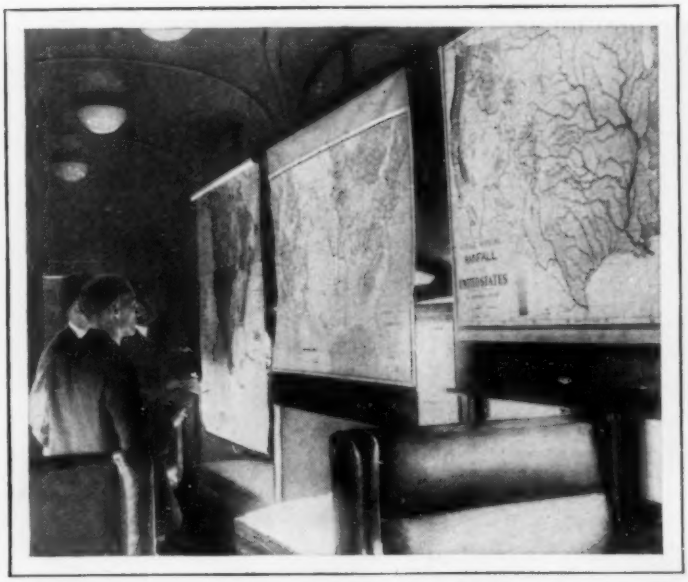
DITCH DIGGER AS FIRE FIGHTER HALTS OIL BLAZE

Operating close to the intense heat of a large oil fire in California, a motor-driven ditch digger did the work of scores of men in forming a trench barricade to halt the progress of the flames. It maintained a rate of 300 feet an hour, scooping out a ditch two and one-half feet deep and eighteen inches wide. Sheets of corrugated iron set on end and lapped over each other were placed in the trench and dirt thrown against them to hold them in place. At times, the flames came so close to the digger that the operator had to abandon the machine. He left it in gear, and it kept an approximately straight line without guidance until he went back to it when the wind shifted and blew the heat the other way.

BEES SWARM ON CAR BUMPER AS SUBSTITUTE FOR TREE

Bumper That Proved Popular with Bees; Swarm Collected While Owner of Car Examines His Visitors

Following their queen, a swarm of some 12,000 bees alighted on the bumper of an automobile parked in a busy Ohio city street. Under similar circumstances, colonies have been known to collect on living persons and on other objects instead of a tree, for the members of the swarm always try to keep close to their queen.



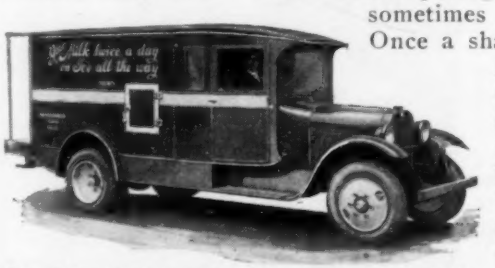
Interior of the "Geology Special," Railroad Car Fitted as Classroom with Maps and Other Equipment

GEOLOGY SCHOOL ON WHEELS IN CROSS-COUNTRY TOUR

To study geology and natural resources first hand, a group of teachers and students from Princeton university toured the country in a specially equipped railroad car. It was fitted with rolling wall maps and other classroom and library apparatus. The trip was arranged as part of a course and was featured by lectures.

REFRIGERATOR IN DAIRY TRUCK KEEPS MILK FRESH

Refrigerating plants on wheels have been introduced on a western dairy farm to keep milk and cream from spoiling during deliveries. They are auto trucks equipped with a brine tank from which circulation is afforded through a series of pipes by means of a pump. Each truck has a capacity of forty-six cases of milk and cream, besides a special can compartment for the larger quantities purchased by restaurants.



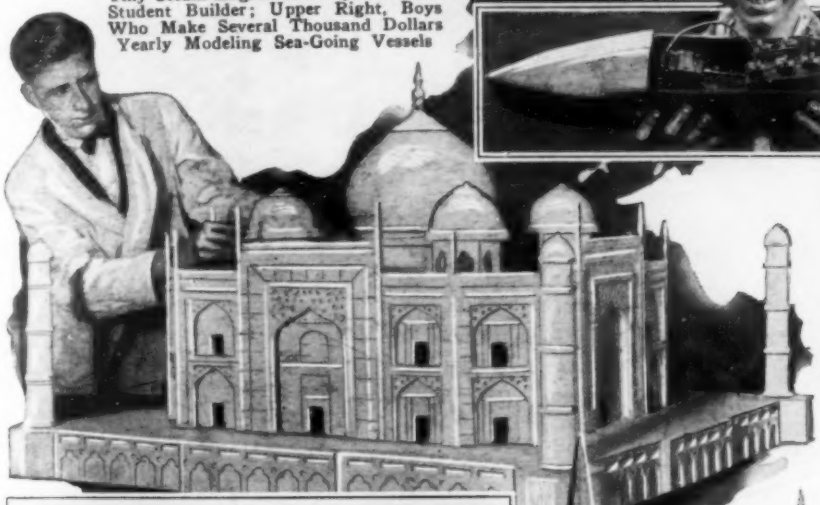
Big Brine Tank in This Motor Truck Keeps Milk Fresh on Long Hauls from Dairy Farm

CABLE REPAIRS SIMPLIFIED BY CHARTS

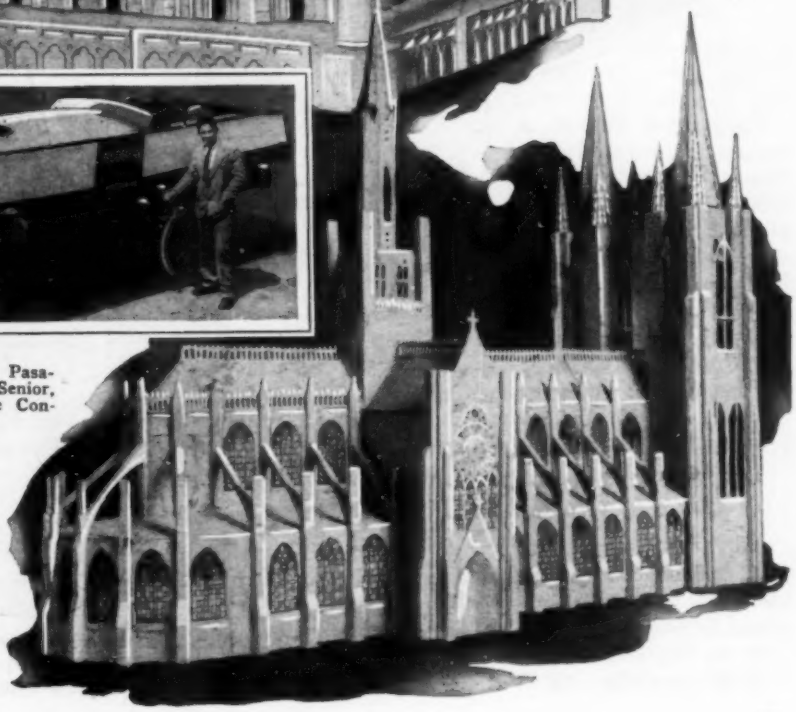
When a break occurs in an ocean cable, it is possible by electrical measurements and calculations from the shore to tell how far from either end the trouble lies. A ship is guided to the spot with the aid of charts on which are marked the position of the line, when it was laid, and any repairs that have been made since. An anchored buoy is set to indicate the point of departure, then the ship steams back and forth across the line, dragging a grapnel resembling a five-pronged anchor over the sea floor. For depths of over a mile, a special form of gripper is used. When it hooks the cable, it cuts it in two and holds one of the severed ends tightly. It is thus easy to lift the line, splice on a new section and connect it to the other end which is raised in similar fashion. Most breaks occur near the shores. The cable has a host of enemies. One of the worst is the teredo or sea worm that bores into ship bottoms and wharves. To protect the wires against these creatures, the shore ends are wound with a layer of brass tape between the insulation and the sheathing wires. In northern waters, icebergs occasionally grind the cables flat, exposing the conductors and sometimes cutting them off. Once a shark bit into the line and its tooth was found in the covering. Another cable was tangled into loops and finally broken by a whale that died in trying to free itself. It was hauled up by the repair ship. The first international cable from Dover to Calais was picked up by a fisherman who thought it was a new kind of eel.

HOW BOYS TURN PLAY INTO DOLLARS

Tiny Steam Engine of Scrap Parts and Student Builder; Upper Right, Boys Who Make Several Thousand Dollars Yearly Modeling Sea-Going Vessels



Robert Taylor, Thirteen Years Old, of Los Angeles, Holding Electrically Propelled Toy Motor Boat He Built and, at Left, Model of Famous Taj Mahal Fashioned by Morris Shamrock, Seventeen Years Old



Joseph H. Moore, a Pasadena High-School Senior, with Hydroplane He Constructed during Spare Hours, and, at Right, Model of Gothic Cathedral Designed by First-Year High-School Art Students of Topeka, Kansas; Windows Are of Painted Isinglass, Giving Effect of Stained Units; Church Is Four Feet Long and Nearly as High

WOMAN RISKS LIFE ON CLIFFS FOR BIRDS' EGGS

Young Woman in Working Costume, Being Lowered over Cliff, and Helper Sorting Eggs

Suspended from a rope sling lowered over the top of a high cliff near a village in Yorkshire, England, a young woman works at the hazardous task of gathering the eggs of sea birds that nest among the rocks. To protect her head from falling stones, she wears a tin hat. Most of the eggs are sold for food and some to collectors.

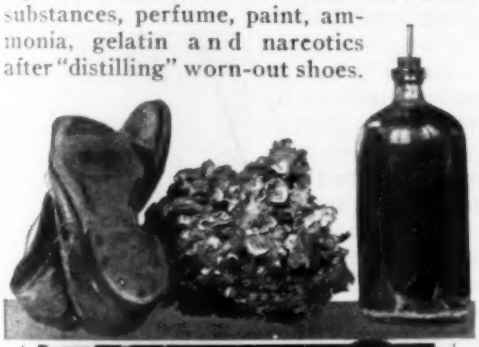
BIG-GAME ANIMALS INCREASING IN NATIONAL FORESTS

Largely due to the protection they are afforded, big-game animals, deer, bear, antelope and elk are increasing in numbers on the 158,000,000 acres of national forests, according to Will C. Barnes of the federal forest service. While showing no increase, mountain goats and mountain sheep are reported to be "holding their own," despite prevalent belief that these animals were threatened with extinction. In 1925, the big game census, taken by nearly 1,000 forest rangers, also included estimates as to the number of beaver. The tabulation showed that some 114,000 of these animals live in the national forests exclusive of Alaska. A bureau of the department of agriculture states that there are some 30,000 antelope in the United States, of which 7,500 roam the federal forest areas. This is an increase over previous years, partly due to migration from lower open ranges. Public sentiment favors the preservation of

the black and brown bear so that these animals can now be hunted only during a limited season when their fur is of the best quality for the market. The 1925 census showed an increase of 2,000 bear in the national forests, although this larger number was believed partly due to the closer count made by the census takers. The grizzly still is scarce. In New Mexico there are said to be but twenty-two members of this species. In spite of the 22,000 deer lost by killing during the hoof-and-mouth epidemic in California, these animals showed a greater increase in that state than in any other. In the east, their numbers are growing also, more than 70,000 being found in the White Mountain national forest. Enforcement of game laws and the destruction of predatory animals have favored the deer.

CHEMIST DISTILLS OLD SHOES FOR MEDICINE AND PAINT

Valuable products have been obtained from old shoe leather by a graduate chemistry student of an eastern college. He is reported to have derived various medicinal substances, perfume, paint, ammonia, gelatin and narcotics after "distilling" worn-out shoes.



Substances from Old Shoes and Refining Apparatus

How Steel Is Aiding the Home Builder; Stilts under House on Bank of Hudson River

HOUSE BUILT ON HIGH STILTS HAS GARAGE IN BASEMENT

Chiefly because of high land values in New York city, lots that otherwise would not be utilized, have been adapted for dwellings so that houses on stilts and in holes along raised streets are not uncommon. An example is an artist's home overlooking the Hudson river. In this case, the lot was thirty to sixty feet below the level of the pavement, but a steel framework was constructed as a foundation and the cellar made into a roomy garage reached by a short ramp from the street. The house is heated with gas and has many other modern conveniences.

PATENTS SOUGHT IN ENGLAND BY SIX HUNDRED WOMEN

Among the 33,033 applications for patents filed during 1925 in Great Britain, 608 were from women. The total represented an increase of 1,633 over 1924. Receipts from patent fees were $1,958,385 and total receipts, including those from designs and trade-marks, were $2,380,220.

Old Grindstones Form Serviceable Stairway as Their Thickness Is Right for an Easy Step

OLD GRINDSTONES AS STAIRWAY STILL SHARPEN KNIVES

One answer to the question what becomes of old grindstones is found in an eastern park where eighty discarded sharpeners have been converted into a stairway up a steep embankment. They have not lost their whetting powers and still will put a keen edge on a pocketknife.

FOUNTAIN-PEN FILLING DEVICE REDUCES LOSS OF INK

Fitting in any ordinary ink bottle a bulb and cup attachment affords fountain-pen users a measured supply, prevents soiling the point and barrel, and reduces loss of ink by spilling or evaporation. Pressure on a small plunger fills the cup with sufficient ink for the pen, and if any is left over, it is automatically drawn back into the bottle when the plunger is released.

TRAPPERS ARE SAVED BY RADIO WHEN MAROONED IN ARCTIC

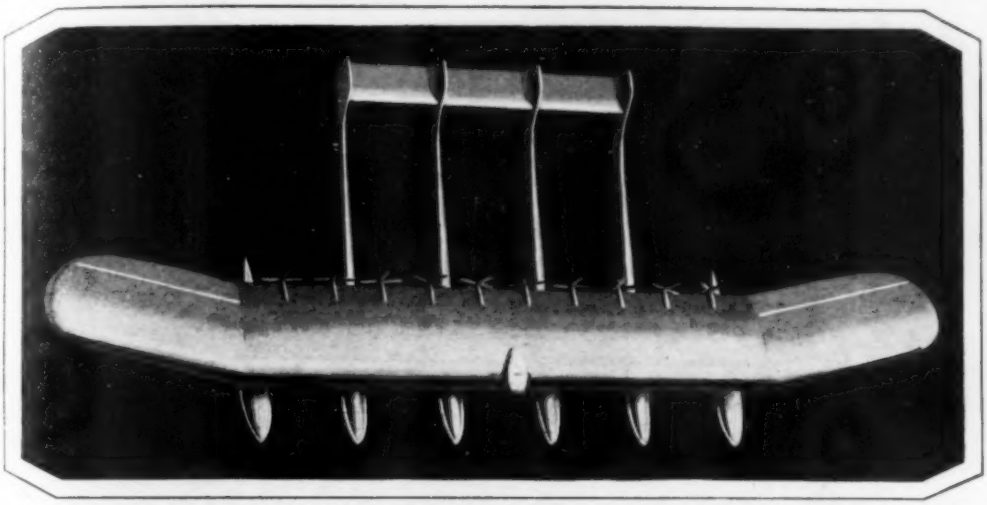
Radio messages sent from station WBZ saved hunters and trappers isolated in a lonely trading post at the extreme northern end of Hudson bay from starvation and possible death last winter. A supply ship with the season's provisions was crushed in the ice and a relief vessel was unable to penetrate to the post during the short Arctic summer. The trading company finally asked the station to broadcast word for a special courier to rush two sled loads of provisions to the isolated men. The call was picked up on a receiving set at Chesterfield inlet and the supplies sent as requested. Weeks later, the radio station received a telegram stating that its appeal for aid had been heard and the distressed hunters relieved.

ALCOHOL BLOWTORCH WORKS WITHOUT AIR PUMP

Burning alcohol as a fuel, a small pocket-size blowtorch employs the heat-generator system to furnish gas under pressure, doing away with the necessity of a pump. The torch consists of two small nickelplated tubes, one containing a large wick in the upper end, and the other provided with a needle-valve outlet curved over just above the wick. The valve is unscrewed and the tube filled with alcohol and enough alcohol poured in the other tube to thoroughly saturate the wick, which is then lighted, and the valve swung back in place above it. The heat from the lighted wick warms the valve and pipe, expanding the alcohol vapor and forcing it out through the tiny valve opening as a stream under pressure, the stream being ignited by the fire from the wick.

¶Our Bureau of Information will answer all questions regarding articles appearing in this magazine.

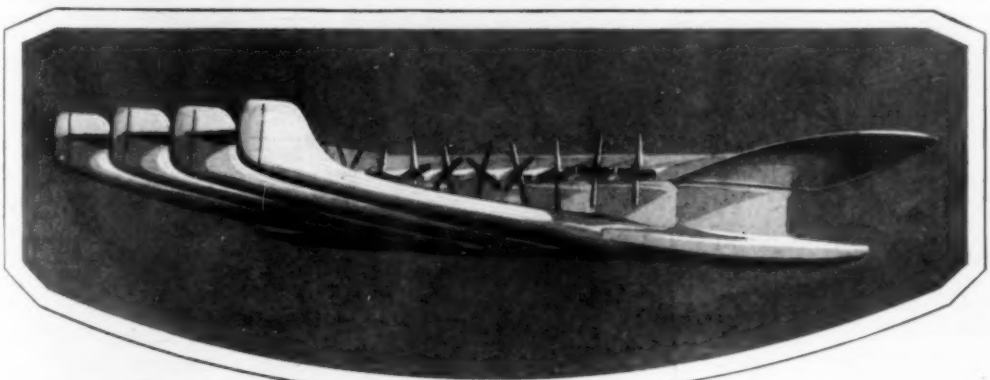
AIRPLANE TO CROSS OCEAN IN THIRTY-SIX HOURS?



Upper View of Model of Huge Airplane Showing Arrangement of Propellers, the Floats and Four Tail Ends, like a Series of Planes "Welded" into One

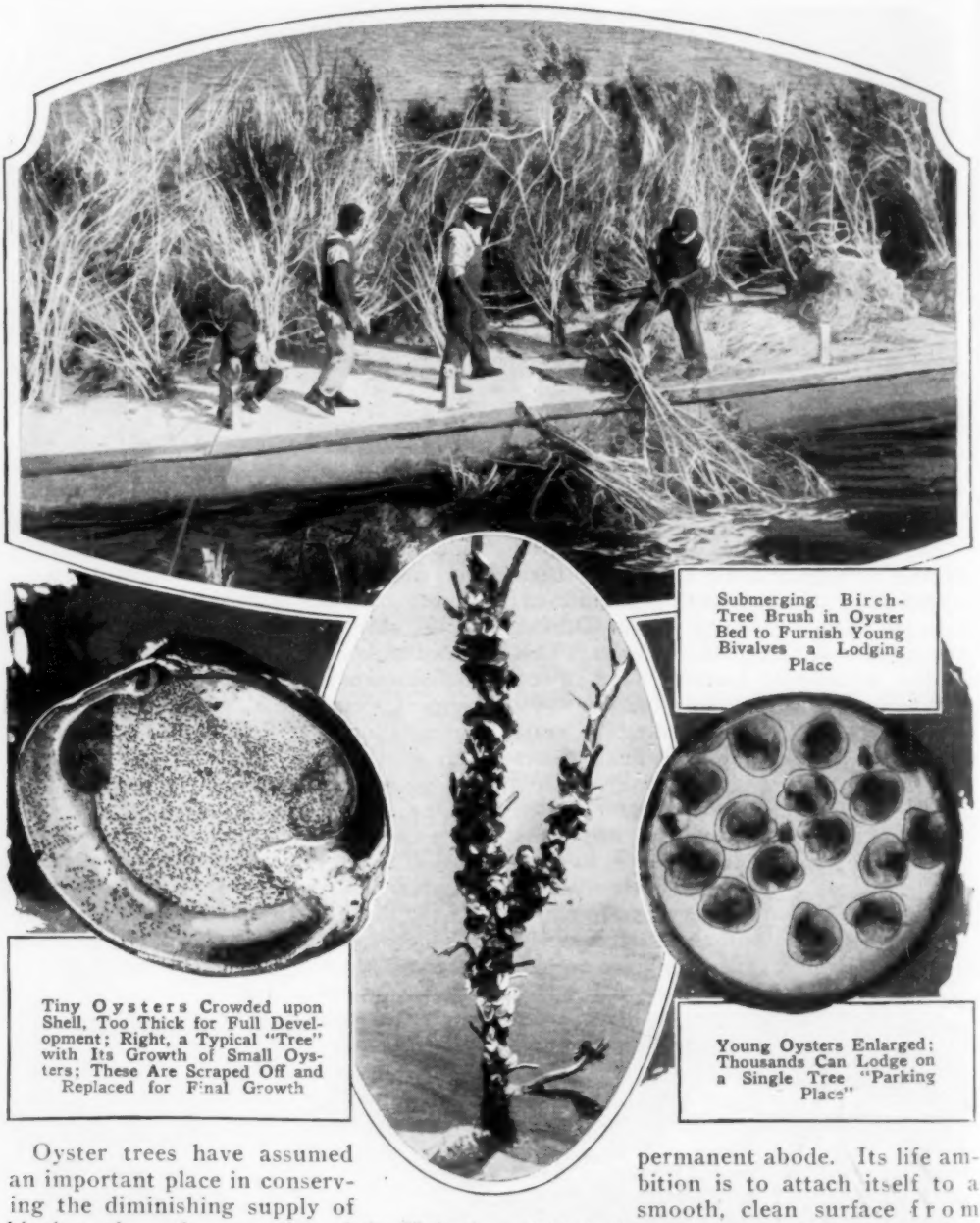
One of the obstacles to adapting the airplane to transatlantic traffic has been the difficulty of constructing a craft capable of carrying heavy loads without bending or collapsing in the center. This problem is believed to have been solved in an "unlimited-span plane," designed by a German expert. Essentially, the craft is a system of several individual planes beside one another and comprising six floats, four of which are full seaplane hulls. Ten 1,000-horsepower motors drive the ten propellers, which are expected to send the plane at full speed from the Azores to New York in about fifteen and one-half hours, and from Hamburg, Germany, in thirty-six. Even if several engines on one side should break down, horizontal rudders are so adjusted as to warrant a possibility of a straight flight. Other parts of the ship are furnished in multiple for added safety. The interior arrangements include separate compartments for passengers, dining and smoking rooms, and quarters for officers, pilots and other members of the crew. The plane will carry 136 persons besides luggage and freight.

One of the features of the plan is a wide corridor at right angles to the direction of flight and between the passengers' quarters and the rest of the ship, to shut off the noise of the motors. A company has been started to construct the plane, patents on which have been obtained.



Side View of Model; the Craft Is to Be Constructed along Lines That Will Reduce Wind Resistance to a Minimum and Support Heavy Loads without Bending in Center

OYSTERS ARE GROWN IN TREES TO PREVENT LOSS



Submerging Birch-Tree Brush in Oyster Bed to Furnish Young Bivalves a Lodging Place

Tiny Oysters Crowded upon Shell, Too Thick for Full Development; Right, a Typical "Tree" with Its Growth of Small Oysters; These Are Scraped Off and Replaced for Final Growth

Young Oysters Enlarged; Thousands Can Lodge on a Single Tree "Parking Place"

Oyster trees have assumed an important place in conserving the diminishing supply of bivalves along the coast line of the United States. In extensive tests, the attempt has been to supply the newly born mollusks with the type of artificial home best suited to their growth. Under natural conditions the baby oyster moves around about two weeks and then takes up its permanent abode. Its life ambition is to attach itself to a smooth, clean surface from which it does not have to move. The surface may be that of a submerged rock, an empty shell, or even a glass bottle discarded by the outer world. The supply of new-born is more abundant than the "parking" facilities. With a hundred or more of the creatures attached to a single

shell, there is overcrowding with a resultant continual struggle for existence, in the course of which a large majority of the oysters are killed. To avoid this loss, the oyster tree has been developed as an ideal anchorage for the baby oyster. The tree is birch, submerged in the form of brush placed in tidal flats and sunk by means of weights. The numerous twigs and branches provide generous space. A single tree will accommodate a colony of thousands of tiny oysters. The tree-grown oysters are transplanted with little difficulty when they develop.

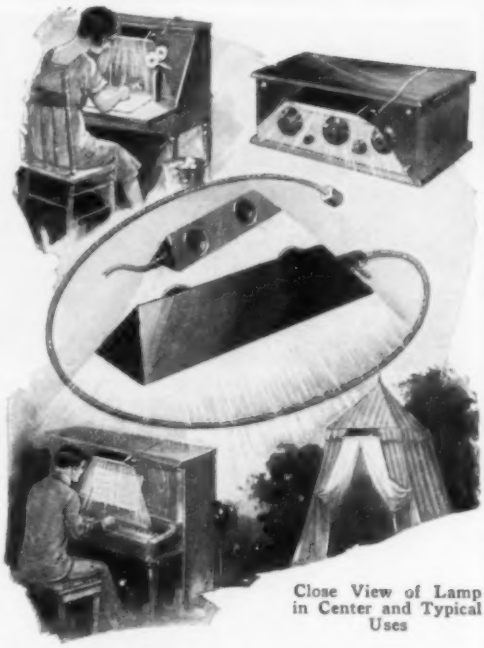
HALIBUT CHANGES SKIN COLOR TO MATCH LODGING PLACE

Besides its shifty eye and turnable spine, the halibut is distinctive because it can change color to match its surroundings. This mysterious power is apparently connected in some way with the eyesight, for when the optic nerve is severed, the change does not occur. Fishermen prevent this color change by laying the fish with its eyes down.

BARROW FOR BRICK AND TILE HAS ADJUSTABLE BALANCE

Constructed of electrically welded steel, a special wheelbarrow for brick and tile has an arrangement at the side whereby the balance can be adjusted for different loads, saving the user strain and preventing upsets. Besides this feature, the barrow has springs to ease the jars, and holes are punched in the bed and dash to permit riveting on old belting or wooden strips to prevent chipping.

Barrow Loaded and Accurately Balanced for Easy Pushing; the Springs Ease Jolts



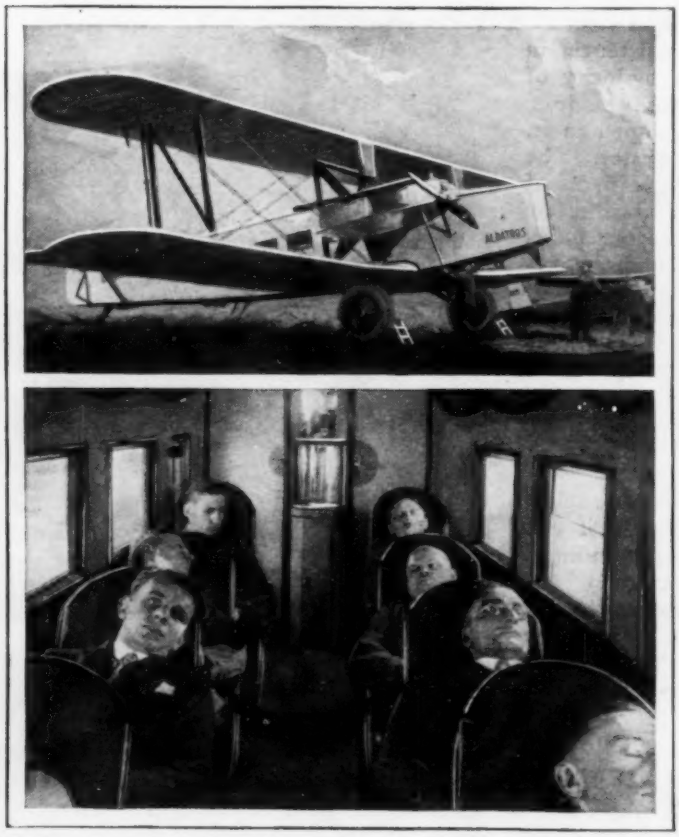
Close View of Lamp in Center and Typical Uses

LAMP HELD BY VACUUM CUPS HAS MANY USES

Fastened to almost any non-porous surface by two vacuum cups, a shaded electric lamp can be used on the piano, for the radio set, the cash register and in many other places. It saves boring holes and making other alterations not always justified in installing a lamp temporarily. A clip is provided for attaching the light to cardboard or other materials to which the cups will not cling.

TESTS FOR MOLDING SAND TO AID FOUNDRY WORK

Through tests whereby foundrymen can tell whether they are using the right kind of molding sand in making castings, better products are anticipated as well as considerable saving in the industry. The material is examined with the aid of special apparatus to determine if it has sufficent strength, permeability and the right texture to prevent flaws and other imperfections in the castings. Costly mistakes can thus be avoided, and it is expected that foundrymen will be able to effect economies in the purchase of sand, an item that now calls for an expenditure of about $8,000,000 a year.



Exterior View of Airplane Sleeper and Interior of Cabin with Its Reclining Chairs Tipped Back for Daytime Naps

AIRPLANE HAS SLEEPING CABIN FOR TRIPS BY NIGHT

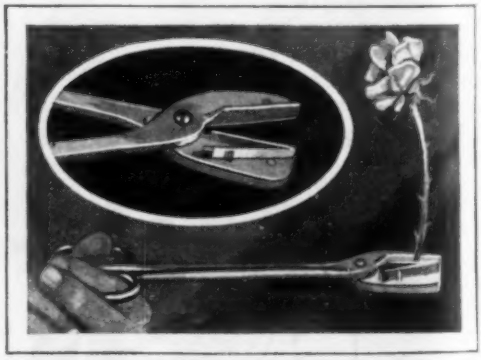
The aerial sleeping car has appeared in Europe in a plane equipped with cabin seats that may be converted into berths for night travel. They tip back at a comfortable angle and may be used for resting during the day. The ship has two motors and is otherwise fitted for luxury and safety.

SUPER-POWER LINES LINK U. S. FROM ST. LOUIS TO BOSTON

Practically all of the northeastern section of the United States is now linked together by a system of high-tension electric-transmission lines. The last gap was closed when a twelve-mile stretch in Pennsylvania was completed. Improved service, greater savings and decrease of interruptions are seen as the outstanding advantages of this system. The Mississippi valley to Boston line, according to the Pennsylvania public-service information committee, will have a total power reserve of 1,200,000 horsepower. It does not permit the transmission of power generated in Missouri to New England, but enables neighboring electric concerns to shift their power loads.

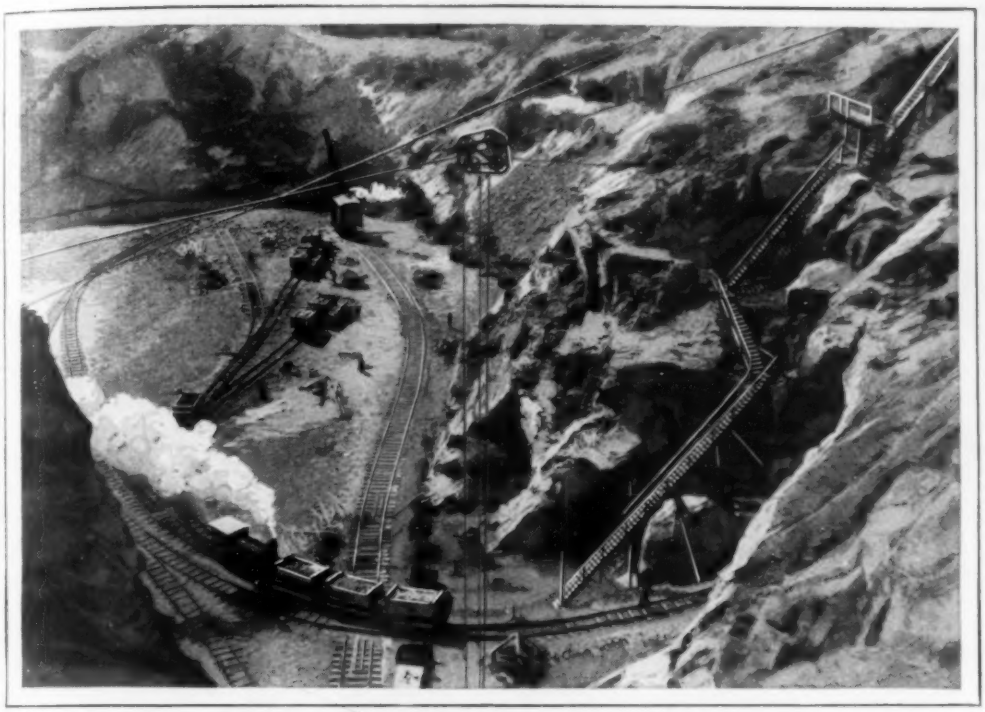
GARDEN SHEARS CLIP AND HOLD FLOWERS

Designed to hold the fruit, vegetable or flower after it is clipped, a new type of garden shears, recently invented, enables the user to reach objects beyond arm's length, using but one hand. When clipping fruit from a tree, or grapes from a vine, particularly if working from a ladder, the novel feature is expected to prove very useful. One side of the blade has an upturned ridge, a quarter of an inch high, and the other side a steel spring lever. As



Flower Clutched in Cutter and Inset Showing Ridge on Blade of Shears That Grips Stem

the fruit or flower is clipped, the stem is held firmly between the two, but the pressure adjusts itself so that even the stem of a delicate flower will not be injured.



Scene at a Busy Canadian Asbestos Mine, Where Nature's Own Fire-Resisting Material Is Dug and Shipped to All Parts of the World; the Entire Plant Covers More Than 100 Acres

DIGGING MINES TO FIGHT FIRES THE STORY OF ASBESTOS

Asbestos for fire protection, insulation, shingles, clothing, and any other purposes, is commonly seen but few persons stop to think that the material is of mineral nature and is mined out of the ground. One of the largest deposits and one that has supplied much of the asbestos used in the last twenty-five years is in the province of Quebec in Canada. The entire plant covers some 120 acres and the product is taken out with electrically and steam-operated apparatus. Several grades of the material are in commercial use, determining qualities being length and fineness of fiber, flexibility, strength and degree of heat resistance.

PLAN TO CASH CHECKS BY RADIO AS AID TO TOURISTS

Promising great aid to travelers, a development of the radio-picture transmission process makes it possible for tourists to cash checks on their banks thousands of miles away and to have the money in their pockets half an hour or so after signing them. A wireless photograph of the check is sent to the bank, which sends back the order for payment by radio. Likelihood of fraud is reduced by this method and persons are spared the inconvenience of carrying large sums with them.

HOLDER FOR WINDOW CARDS SAVES USING PINS

Milk, ice and other cards, as well as window decorations, are displayed without the use of nails, tacks or pins, with the aid of a holder that can be slipped over the bottom of the shade and has a spring clasp to keep the card in place. It may also be suspended from the top of the lower shade.

House Profits Are Doubled by Making One Roulette Wheel Serve Two Board Layouts, Giving Twice as Many People the Chance to Risk Their Money on Systems That Look Good but Aren't

Here's How the Gambler Hides His Percentage So That, No Matter What the Result of the Game, the Winners Lose in the End

THERE is an old saying around the race tracks that you can beat a race, but you can't beat the races. The gambler who first made that discovery didn't add anything to the sum of human knowledge, for expert mathematicians had settled the question long before horse racing became a business, and settled it not only as regards the race-track gambler, but every other form of risking money.

There are runs of good luck and runs of bad luck, but the mathematical laws of chance demonstrate conclusively that, in the long run, the best the bettor can do is break about even—provided the odds are right and the game on the square. No commercial gambling proposition, however, from the nickel slot machine to a roulette wheel, gives the bettor an even break — bookmakers and slot machine and gambling-house owners insist on the "house percentage" to make sure that they will make money. Against such odds you can't win.

How many millions are bet—and lost—on horse races at American tracks in a year's time is a matter of conjecture, but more than a million and a half is regularly bet, at the track, on a single race, the Kentucky Derby. Bets made at the track, however, are only a small percentage of the bets made on any race. A crowd of 50,000 or 60,000 is a big turnout for any

Even an Honest Pair of Dice Doesn't Give the Crap Shooter a Fair Run for His Money, for the Odds Are Wrong

CAN'T WIN

The Sport of Kings Is America's Best Money Maker for Professional Gamblers, Because of the Ease with Which Odds May Be Shaved

race track, but in New York city alone it is estimated that more than 300,000 people regularly play the handbooks, while the total of handbook devotees in the country probably exceeds five millions.

If you add up the odds offered by the bookmaker on any given race, you can determine approximately how much he expects to take away from his customers or, as they are called by the "talent," the "suckers." Say there are nine horses entered in the race. Reduce the odds offered to fractions, add up, and the result, if it was an honest book, at fair odds (which no book can be, if the bookmaker is to earn his living) should total one. If the total is more than one, as it invariably is, the bookmaker is going to win, while, if it should be less than one, which it never is, the bookie would be in for a loss.

The shaving of the odds is only one small angle in the despoiling of the suckers who bet on races. Every bookmaker, tout and racing sheet frankly admits that the game is fixed; in fact, the more crooked they can make it appear, the more suckers they can get, through the curious twist of human nature which makes millions seek to profit through "inside knowledge" of the crookedness. The green-goods salesman, who takes a thousand or so for a lot of newspaper clippings supposed to contain many thousands in bills, has been profiting on this quirk of human nature for generations.

Every turf-tip sheet contains frequent reference to "sleepers," horses which are "ripe for a killing," yet the bettors who accept the tip and bet on the horse ignore the fact that, if the tip is true, then the owner, trainer and jockey have been in a conspiracy to mulct the public. A sleeper is a horse that has been deliberately held back to make a poor showing in several races, so that eventually long odds will be quoted against it. When the time comes for the killing, the horse is entered in a race where it is pretty sure to win, and the owner's money is sent to other cities to be bet away from the track in small sums, so the bets will not pull down the odds. The process of having the horse lose repeatedly is called "qualifying" the animal, though really it is the betting public that is getting qualified.

One of the racing handbooks a couple of years ago, announcing a marvelous new way to beat the races by parlaying bets, attacked all other forms of gambling by

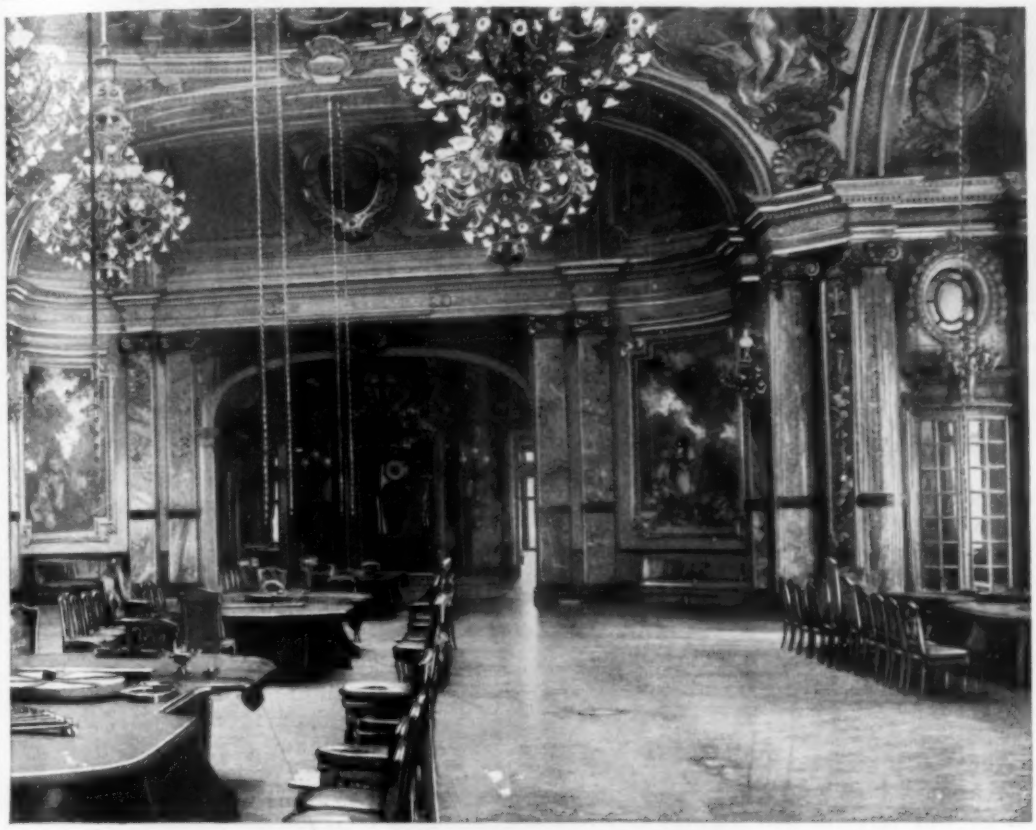
One of the Gorgeously Decorated Gambling Rooms in the World-Famous Casino at Monte Carlo, Where the House Percentage Pays All the Cost of Government for the Entire Principality

quoting the odds against the player. The figures in some cases were understated rather than overstated, but they included odds of five and a half to nineteen that the roulette player would lose; nearly two per cent against the man "fading" another in a crap game; more than two per cent against a faro player; "considerably" against the guesser in a coin-tossing match, and gave the added information that poker "eventually will break the player in a game where the house takes out a percentage."

Poker, as a matter of fact, can break a player in more ways than one, and in "friendly" games where there is no house deduction. The gambling-house practice, however, of deducting a certain sum from card games to pay expenses makes the result, so far as the players are concerned, no different from a group of friends who pool their money, draw to see who wins, and let a stranger take out part of the pile for supervising the job.

There are probably more poker players in the United States than players of any other single card game, but out of the millions, comparatively few amateurs have any correct conception of the chances of filling any given hand. With a deck of fifty-two cards it is possible to form 2,598,960 different five-card hands, but 1,302,540 of these will have no poker value, that is, they will not even have as much as one small pair.

Most poker players know it is safer to draw to a straight open at both ends than to one open only at one end, or in the middle, and they likewise have observed that there are fewer "openers" out in a three or four-handed game than in a larger one, but have never stopped to apply the knowledge to their playing. As a matter of cold mathematics, if a big pair



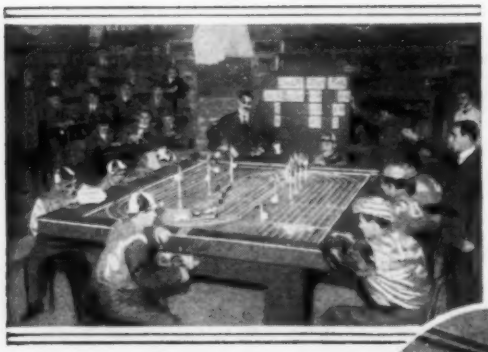
The Rulers of Monte Carlo Abolished Taxes Because of the Vast Gambling Profits, and Likewise Barred Their Own Subjects from the Casino, Where Only Foreigners Are Permitted to Lose Money

is a good hand in a game of three persons, then small threes is the lowest hand on which it is safe to stay in a game of four or five, and big threes, or even better, in a game of six or seven players.

Out of the 2,598,960 five-card hands which can be formed from a poker deck, there are only forty possible straight flushes, four of which, of course, are the royal flushes. It is possible, however, to form 624 different sets of fours, and 3,744 full houses. Next there are 5,108 ways in which flushes can be made; 10,200 straights; 54,912 sets of threes; 123,552 hands which would contain two pairs, and, finally, 1,098,240 hands containing single pairs. There is no absolutely unbeatable hand in poker as now played, for the holder of a royal flush might possibly, though it is highly improbable, meet a similar hand, and halve the pot. In former days, however, before flushes were recognized, there was one unbeatable hand—four aces—for the man who had them knew to a certainty that no one else could hold that same hand.

It is curious to note that more than one-half of all the five-card hands which can be formed from a poker deck do not even contain a small pair. Except for the general rule requiring a pair of jacks or better on which to open a pot, an ace-high hand would be a good one on which to stay, in the long run, for it would give an actual percentage in favor of the player.

Going back to horse racing, it is equally interesting that ten horses in a single race can finish in 3,628,800 different ways. An amusing story is told of a gambler in Australia who thought this curious piece of information offered an easy way to make money, so he began wagering on the question, but, unfortunately for him, met a man who was a bit smarter, and who



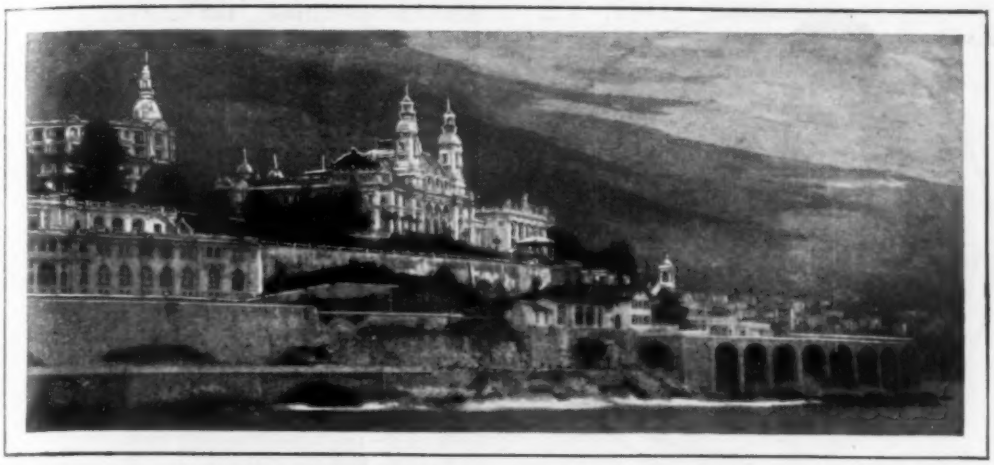
Berlin's Latest Gambling Game Is a Mechanical Race Track with Real Jockeys for "Atmosphere"; in the Center Is a Betting Machine in a London Club, and Below, Chicago Officials Are Wrecking Slot Machines

phrased the question, "In how many ways can ten horses be placed?" instead of in how many ways can they finish. Only three horses can be placed in a race, first, second and third, so there are only 720 combinations, there being 120 actual sets of threes in a ten-horse race, but each set can finish in six different ways.

Next to betting on horse-race tips, there probably has never been any gambling scheme which brought out as many "sure-thing" systems as roulette. The practice of doubling after each loss until the player wins is impractical for two reasons: the limits of the player's pocketbook and the limit fixed by the house, which commonly ranges from fifty cents or a dollar to $100 to $500. Even if the limit of an individual bet were removed, the player who had a run of bad luck would find the arithmetical progression affecting his purse. Say, the player sits down at the table with $1,030 and starts wagering $1, but meets a run of bad guesses. The first loss would be $1, doubling the bet he would lose $2 the next time, then $4, $8, $16, and so on. If he loses his tenth bet of $512, he will have paid out $1,023 and, with only $7 left, must stop playing. It is probable that more people have spent more time trying to figure out a way to break the bank at roulette than have tried systems in any other one game. Roulette lends itself to system playing more than a card game, because the layout is so simple, and the whole thing is visible on the board, whereas the mathematical laws governing cards are more or less of a mystery.

Most of the roulette systems are attempts to get away from the huge losses attendant to attempting to double bets after each loss until one wins. Such systems, called martingales, can actually be worked, but have the drawback that they limit winnings to a very small sum, and even then aren't always proof against misfortune. Most of the systems are based on some one of the possible variations of divided plays. The player decides on an amount to be risked in each play, say $6, and then divides it in three or four parts, such as one, two, two, and one dollar, setting the figures down in a row on a sheet of paper. He starts out by betting the first dollar, continuing until he succeeds in losing it.

Center Photo © Keystone



The Mecca of Society Gambling, Until Recent Years, Has Been Monte Carlo, Perched on the Hillside above One of the Most Beautiful Bays on the Mediterranean; the Casino Is in the Center

and pocketing any winnings in the meantime. As soon as he loses a bet, he puts the amount down at the bottom of the column and then bets the sum of the top and bottom numbers, in this case $2. If he wins, the two numbers are crossed out and the next top and bottom sum bet, while, if he loses, the $2 loss is set down and the new sum, now $3, is wagered. The play keeps on until all the figures in the column have been crossed off—and the player has won $6. No matter what sum he fixes as the basis of play, the winnings in any one cycle of plays will be that amount, provided a long string of losses doesn't run him above the table limit before the cycle is completed.

Starting on a $6 basis, twenty bad guesses would entail a loss of $210, though the twentieth bet would be but $20, so the system would be fairly successful in avoiding the table-limit rule, but after it is all played out, the final winning is but $6.

The gambling house, of course, does not depend on the individual player's luck, or rather bad luck, to make its profit. That is all nicely taken care of by the zero, or, on many roulette wheels, the double zero, on which the house wins. With thirty-six numbers on the wheel, one or two for the house do not appear to be such a great percentage, particularly when the house explains that it is merely an exchange for the favor extended the player of varying his bets at will. Yet, as a matter of mathematics, it gives a very decided advantage to the house.

Any form of gambling game ever invented can be reduced, for examination of its mathematical chances, to the simplest of all gambles—tossing a coin. Over a long period of tossings it is practically certain that approximately one-half the results will be heads and the other half tails, so it is a fair fifty-fifty bet which will lead at the end, say, of one hundred tossings. But, after a run of ten or twenty consecutive heads or tails, it is still a fifty-fifty bet that the next toss will be either the one or the other, and you can take your choice. The fact that for ten or twenty consecutive times the toss has given the same result has not altered the mathematical fact that the next toss is still an even bet.

The failure to make allowance for that fact is one of the chief handicaps of an inexperienced bettor. When a player has had an unusual lucky run at craps there are always more people ready to bet against him, figuring his luck must change, and when one has had an unusually unlucky run, he is often prone to overplay to recoup, figuring again that luck must change. Over a long series of plays, running into the hundreds or thousands, there is justification for the idea of changing luck, since eventually the winnings and losses will average, more or less, provided the game is fair. But in the immediate game an unusual run of good luck or bad luck does not alter the fact that the next play still is one with equal chances of continuing or changing the run.

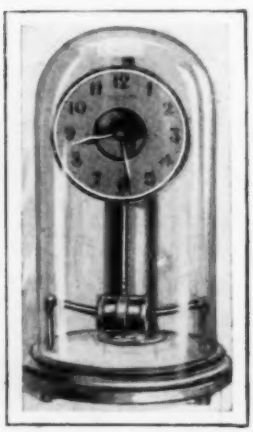
Duplicator in Service; It Is Rocked Back and Forth like a Desk Blotter

PICTURES AND WRITING EASILY COPIED FROM STENCILS

Letters, drawings and similar subjects are quickly reproduced in a hand-operated duplicator which carries the stencil on a curved ink pad, rocked back and forth to make the impression. A feature of the outfit is an automatic alinement apparatus which insures straight margins and registration of all the copy.

CLOCK TO RUN FOR TEN YEARS ON SINGLE BATTERY

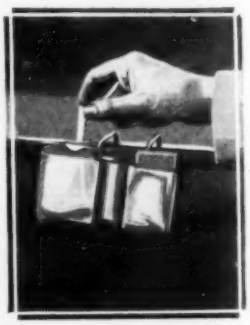
Requiring no winding, wiring or connections, electromagnetic clocks introduced by a French firm are intended to run for ten years on one battery. The actual consumption of electrical energy, according to careful tests, is but 1.2 watts per year and approximately seven-eighths of this is regenerated by the clock's mechanism, functioning as a dynamo. These timepieces are said to require no cleaning or lubricating, are precise, regardless of temperature conditions, and are easily regulated. If stopped, they start going of their own accord.



LEGEND OF FRANKLIN AND KITE DOUBTED BY HISTORIAN

Benjamin Franklin may not have performed the experiment with the kite and the key, as popular biographies narrate, and he probably was not the first to test the principle of lightning rods, but these doubts in no way detract from his greatness as a scientist, according to Prof. Marcus W. Jernegan, of the University of Chicago. Franklin is believed to have first suggested determining the identity of lightning by means of a rod, but French investigators are thought to have made the proof. Pictures of Franklin flying a kite, while his small son stands by, are misleading, Prof. Jernegan holds, for at the time of the experiment, if made at all, the son was twenty-three years old. The historian deplores the fact that a suitable monument has not been erected in Franklin's memory.

SMOKER'S KIT ON AUTO DOOR SAVES ROOM ON DASH

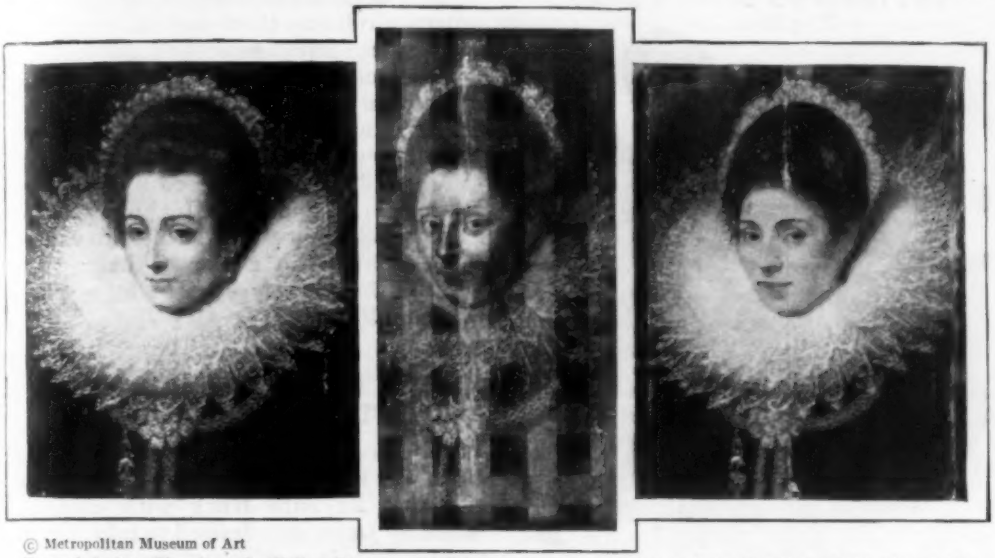


Holding cigarets, matches and a receptacle for ashes, a smoker's kit is fastened to the automobile door with rubber-covered supports. It is in an accessible position, does not interfere with opening or closing the door and has proved popular with many drivers who find the dashboard sufficiently filled with instruments without adding another.

ELECTRIC OIL BATH FOR EGGS HALTS SPOILING

Eggs are sealed from air to aid their preservation by passing them through an oil bath heated by electricity to 235 degrees Fahrenheit. The liquid fills the pores so that decomposition is delayed.

OLD MASTER IS RESTORED BY THE USE OF X-RAYS



© Metropolitan Museum of Art

Portrait before Cleaning, the X-Ray Photograph Showing Overlying Colors and the Cradling Which Braces the Panel at the Back, and the Restored Painting; Note Larger Nose, Fuller Lips and Other Changes

How science can be combined with art and successfully applied in solving a difficult problem, where the identity of a painting by a master is at stake, is revealed in the restoration of a "Portrait of a Lady," by Frans Pourbus, which is now in the Metropolitan Museum of Art. Through the process of a thorough X-ray treatment, this picture has finally been identified as a genuine example of the master.

It appears that the woman's face had been overpainted with newer pigments and, to all appearances, was an old portrait with a new face. Experts examined the painting and discussed the problem, wondering whether an old face would be found underneath or whether the original had been lost beyond recall. According to Alan Burroughs, who conducted the experiments, the X-rays, broadly speaking, distinguish between old and new paint. The densities of the several pigments employed appear upon the X-ray film as well defined shadows, and from these the trained eye is able to determine facts not evident from examination of the surface.

The Metropolitan museum has reproduced three illustrations showing the different states of the painting before cleaning, a typical X-ray film taken from the portrait, and the portrait after it had been cleaned and restored. The X-ray recorded a woman's face differing in several respects from that on the surface of the painting. Her nose was larger, her lips fuller, her eyes more slanting and her face more pointed. Whereas the face seen by the naked eye had the prettiness of an "ideal portrait" of recent times, the face revealed by the shadowgraph is that of a real person. Closer examination of the X-ray pictures showed that the painted surface beneath the repaint extended intact over the middle portion of the panel, the only damage being a chip out of the forehead and a crack running through the left side of the face. The crossbars over the entire panel are a shadow record of the cradling which braces the panel at the back. The cradling and repaints on the front hid from the eye the fact that the original panel had been inlaid in a panel larger by about one and one-half inches on each side, but the X-rays revealed the fact as can be observed in the darker band at the top and bottom of the shadowgraph. On the evidence of the X-ray, the museum had the panel cleaned of its overlying colors, with the result shown in the third reproduction.

¶Nearly all snowflakes are shaped in some variation of a six-pointed star.

FIREPROOF BASKET FOR WASTE IS FIXED TO OFFICE DESK

Desk Waste Basket in Use

Attached to the desk where it is reached easily, a waste-paper basket consists of two metal sections. One is the container proper and tips outward when material is to be placed inside, or is easily taken out by a single upward and outward movement of emptying. It falls back inside the outer shell when released, preventing exposure of the contents. The basket is finished in a variety of colors to harmonize with the rest of the office equipment.

AROUND WORLD IN SINGLE DAY FEAT OF FUTURE?

When Linton Wells and Edward S. Evans lopped nearly a week from the previous world's record for circling the globe, conjectures began as to how long their time of twenty-eight days, fourteen hours and thirty-six minutes would stand. Evans predicts that in a few years, their record will be as humorous as Nelly Bly's, several hours more than seventy-two days. In fact, he points out, there are airplanes today fast enough to fly around in less than twenty-four hours, starting and returning to Point Barrow, Alaska, as the distance there is but 6,000 miles. The chief doubtful factor is that the craft are not yet equipped for a dependable flight of such long duration. Evans and Wells covered more than 20,000 miles, using seven modes of travel which involved seventeen airplanes, three special trains, two liners, many small boats and autos, a jinrikisha and their feet. Two thirds of their plans went wrong but their own resourcefulness and the co-operation of others helped overcome these difficulties. The roughest flying encountered was between Pasco, Wash., and Boise, Idaho, where the air was so "bumpy" that sharp dips caused the carburetor to choke at times. The part of the journey covered by airplane totaled 8,500 miles.

AUTO TRUCK FOR ICING CARS CUTS SWITCHING COST

Switching refrigerator cars to the icing racks was found so expensive in a western city that an auto truck with elevator, raised by jacks, was devised to take the ice to the car. It carries sufficient ice for a whole car and the screws which lift the load are actuated by gears operated by the truck's motor.

Icing Freight Car from Truck; Cakes Are Hoisted on Elevator Run by the Motor

PONY EXPRESS TO PLANE TALE OF TRANSPORTATION

Inauguration of mail and passenger service between Philadelphia and Washington by air recently recalled the rapid transportation developments in this country. Three important stages in this growth were illustrated in a tableau at the Sesquicentennial exposition. It included a saddle horse, signifying the times of the pony express, an automobile and the first airplane for the new mail-carrying route between the two cities.

Three Stages in Transportation Illustrated at Sesquicentennial Exposition; the Horse Typifies Days of the Pony Express; Next, the Motor Car and Finally, the Speedy Airplane

FINDING OF NEW GOLD FIELDS REVIVES MINING INDUSTRY

Recent discoveries of gold in northern Ontario, southern California and the republic of Panama, promise enrichment of the world's supply and stimulation of that branch of the mining industry, which suffered heavily during the war. Whether these finds will prove abundant, remains to be seen, but the general activity is welcomed as improved transportation facilities, opening of new districts to agriculture and other pursuits and the establishment of permanent commercial centers often follow in the wake of a gold rush. The old-time prospector with his crude equipment is disappearing before the technically trained treasure hunter with his portable testing outfits, automobiles and even airplanes. But gold mining has slumped. The world's annual production is some $80,000,000 below what it was previous to the war. And digging for the precious metal is not always a "gold mine" financially. In 1925, only seven companies in the United States paid dividends. Their total was about $3,000,000. Exhaustion of deposits, high labor and equipment costs and the expense of opening new fields are some of the contributory causes to this condition. A bonus for new gold was sought in congress, although some operators were not in favor of the movement. But the bills failed to pass principally because of the sudden decline in prices due to deflation in 1920. Africa leads the world in gold production.

LEVER TO TIGHTEN TENNIS NET AIDS ACCURATE GAME

Playing with the net too high or too low is a common fault in tennis, for accurate adjustment is bothersome and often difficult with the usual string fastenings. This detail is simplified by means of a lever attached to one of the posts. Raised or pressed down, as needed, to keep the net at the proper height, it remains in that position until released. The adjustment is quickly done.

Pressing the Lever Raises the Tennis Net to the Correct Height and Keeps It There

The Famous Rattlesnake Flag of 1775-76 with Red and White Stripes; Variations of This, with Different-Colored Stripes, Were Flown Astern on Private and State Ships

Mystery Shrouds Origin of Our Flag

All Nations to Honor Stars and Stripes Which Has Remained Unchanged Longer than Banner of Any Other Nation

WHO suggested the idea of incorporating a stripe and a star for each of the thirteen colonies in the first American flag remains a mystery on the eve of the 150th birthday of Old Glory, which will be celebrated June 14, next year.

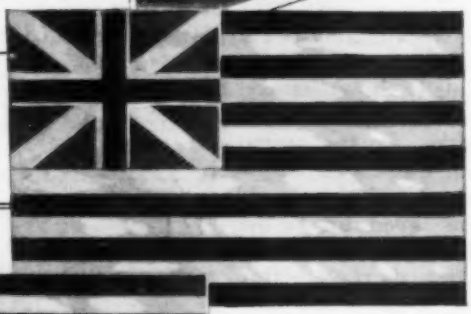
The commonly accepted story that Betsy Ross, a Philadelphia flag maker, was the author of the idea, is discounted by evidence displayed this year by the navy department at the Philadelphia exposition, though it is quite probable that she was the maker of the first American flag, as her shop was only a few doors from the meeting place of the Continental Congress when the design was authorized.

The navy exhibit, however, shows that flags with thirteen stripes had been used on land and sea by the colonists more than a year and a half earlier, and that a flag with thirteen stars in the union had been hoisted two years earlier by the schooner "Lee" and the Rhode Island colonial troops. The "Lee" flag, with its five-pointed stars grouped on a blue union, bore an anchor surmounted by the word "Hope." It marked the first known use of stars in an American flag, and was unfurled soon after the battle of Concord, in 1775.

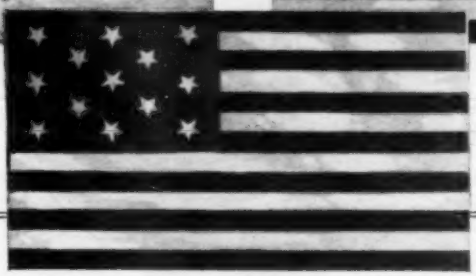
On December 3 of the same year the newly formed American navy gathered off Philadelphia and raised a flag with thirteen red and white stripes, but retaining the union of the British jack. On Jan. 1, 1776, six months before the Declaration of Independence, the same flag was unfurled over the Continental army at Cambridge. A year and a half later the main features of the two flags were combined

Flag of English East India Company, 1704; the Earlier Banner of This Concern Had More Stripes

Schooner "Lee" Flag of 1775; First Appearance of Stars; Note They Are Five-Pointed and Arranged in Parallel Rows



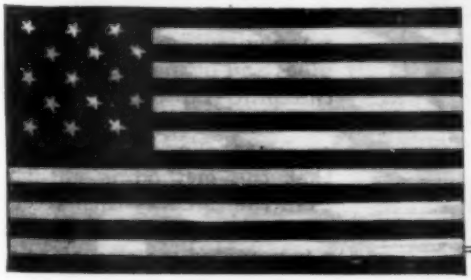
Grand Union Flag, Hoisted Dec. 3, 1775, over Newly Founded American Navy and Jan. 1, 1776, over Continental Army

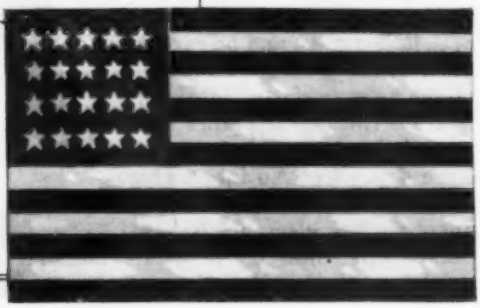


Fifteen Stars and Fifteen Stripes; It Was This Style, the "Star Spangled Banner," That Inspired Francis Scott Key's Poem

Adopted June 14, 1777; Starry Union Borrowed from Schooner "Lee" Flag

Designed by Capt. S. C. Reid of U. S. Navy, the Flag of 1818; It Is Still in Use Though with More Stars





in the original Stars and Stripes—the union of the "Lee" flag replacing the British union.

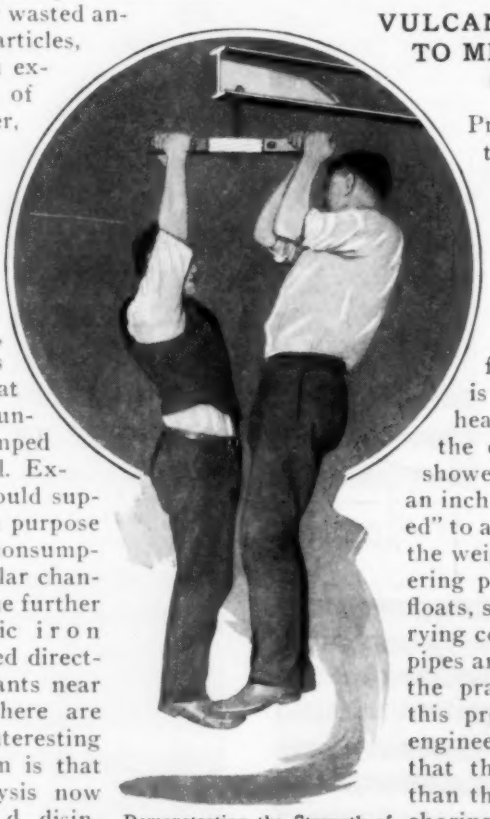
The original idea of using stripes possibly goes back to the familiarity of the colonists with several flags employing the same device. The British East India company's flag of 1704 had thirteen red and white stripes, and was a common sight in the ports of the colonies, while the colonists who came over from Holland were accustomed to the flag of the United States of Netherlands, with its stripes of red, white and blue. In fact, the flag of New Netherlands, as New York was known while still a Dutch possession, had the same stripes and colors.

During 1775-1776, while the navy flew the grand union flag, with its thirteen stripes and the British union, at the stern, the ships also displayed a jack in the bows which featured thirteen red and white stripes crossed by an uncoiled rattlesnake, and, in the bottom white stripe, the legend, "Don't Tread on Me."

From May 1, 1795, until 1818 the Stars and Stripes had fifteen stars and fifteen stripes, two having been added for new states. In 1818, the law establishing the present flag, designed by Captain S. C. Reid, U.S.N., was passed, providing that thereafter the stripes should be limited to thirteen for the original colonies and one star added for each new state.

REDUCE IRON AND STEEL WASTE BY ELECTRIC PROCESS

Nearly 20,000,000 tons of iron and steel, approximately twenty-five per cent of the yearly output, are now wasted annually in castaway articles, according to a British expert. In the opinion of an eastern engineer, much of this could be saved for re-use by electrolysis. He suggests the erection of large tanks, conveniently placed and containing an iron solvent, in which cans, old automobile bodies and other articles that now disfigure the countryside could be dumped and the iron reclaimed. Existing power plants could supply electricity for this purpose during hours of low consumption through the regular channels, he believes, and he further holds that electrolytic iron might be manufactured directly from the ore at plants near waterfalls where there are large deposits. An interesting phase of this problem is that uncontrolled electrolysis now causes corrosion and disintegration of piping and structural framework, but improved methods of construction and insulation will reduce losses from this cause to a great extent, the engineer believes.



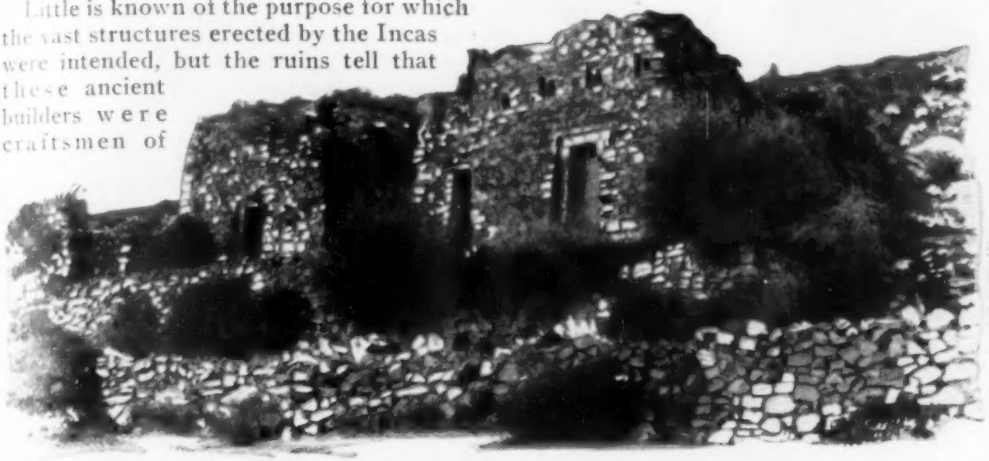
Demonstrating the Strength of Rubber "Weld" on Steel; Strip Supporting Men Is Inch Square

VULCANIZING RUBBER TO METAL PREVENTS CORROSION

Promising great service to industry, a process for locking rubber to wood or metal has been developed by chemists. A specially compounded cementlike product is applied to the surface, then the rubber is vulcanized either by heat or air, the latter in the case of wood. Tests showed that a rubber strip, an inch square, and so "welded" to a steel beam, supported the weight of two men. Covering pontoons and seaplane floats, steel-tank cars for carrying corrosive acids, interior pipes and fittings are a few of the practical uses to which this process can be applied, engineers say. It is reported that the method is cheaper than the old way of first anchoring hard rubber layers to a corrugated metal surface.

RUINS OF INCA PALACE SHOW ANCIENT BUILDERS' SKILL

Little is known of the purpose for which the vast structures erected by the Incas were intended, but the ruins tell that these ancient builders were craftsmen of the highest order. An illustration of their work is found in an old sun palace on an island in Lake Titicaca, between Peru and Bolivia, 12,000 feet above sea level, the highest lake in the world to be traversed by steamers. The stones were so carefully cut and fitted that most of the walls withstood the hands of the invaders and have resisted the ravages of more than 400 years. Fragmentary evidence indicates that the "people of the sun" were also skilled as metal and pottery workers, good road builders, spoke at least two languages and had a highly developed labor and colonization system. They are believed to have settled near Lake Titicaca about 300 years before Pizzarro arrived near the Peruvian coast in 1527.



Ruins of Inca Palace on Lake Titicaca Island; the Huge Structure Apparently Was Erected for Religious Purposes; Workmanship of a High Order Is Revealed in the Masonry

ATLANTIC NEW YORK'S "FISHIN' HOLE"

More than 1,000,000 men enjoyed the sport of deep-sea fishing near New York city last season, according to reports. Special boats carry large groups of anglers to charted locations. The craft, as a rule, are in charge of veteran fishermen experienced with tides, winds and weather, and expert at taking their patrons to places where the principal catches, bass and blackfish, are likely to be found. Upholstered chairs, dining and lounging rooms are provided on many of the boats and some have complete tackle outfits for sale as well as bait of all kinds. They leave at intervals from midnight until late afternoon and, at weekends, are usually crowded to capacity.

BICYCLE POLO GAME ON BEACH LATEST OUTDOOR SPORT

Bicycle polo proved a popular novelty at a California beach this summer. Special sticks of short length enabled players to strike the ball at close quarters and the hard sand made a good surface for the maneuvering of their "ponies."

Bicycle-Polo Enthusiasts, Enjoying a Game on Sandy Beach; Skill and Alertness Are Demanded and Beneficial Exercise Is Afforded Arms and Legs

DOUBLE DIAL IN HOTEL DOORS INSURES GUEST PRIVACY

Hotel Guest Setting the Dial from Inside Room and Maid Reading the Indicator

Set in the hotel-room door and regulated from the inside, a little dial indicator shows the hour at which the occupant intends to leave. Besides preventing disturbance, the arrangement helps attendants in their work as they are informed when they may visit each room and delays are thus avoided.

WOMEN THE FASTER WORKERS EXPERIMENTS SHOW

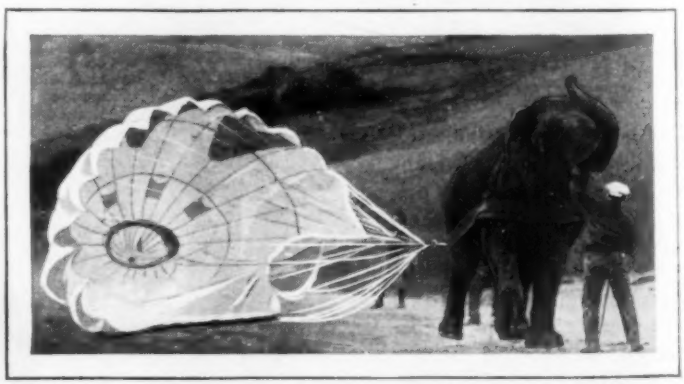
Laboratory tests held at Johns Hopkins university show that women can do more work in a given time than men, but men display superior judgment. The tests involved substituting letters for symbols and were given to 542 women and as many men, college students in various part of the country and ranging in age from nineteen to thirty-nine. Judgment of the subjects was measured by requiring each to estimate, in advance, how much work could be done in the time given, one minute and fifteen seconds for the first test, and one minute for the second. There was little difference in attention to directions and correctness of substitutions. The women worked faster, but were less accurate in estimating how much work they could do.

ONE DEATH IN MILLION MILES RECORD OF AIR TRAFFIC

In the forty-seven months preceding June 1, army flyers covered more than 1,000,000 miles with the loss of but one life. During that period, 1,197 passengers and 61,412 pounds of express were carried a total distance of 1,098,373 miles in 14,644 flying hours. Flights started totaled 691, of which 662 were completed. There were twenty-six crashes with but two accidents to personnel. These figures were compiled at the United States airway control office at Fairfield, Ohio, and refer to operations of government planes, which are now extensively used for carrying officers, messages and parcels of importance.

TEST STRENGTH OF PARACHUTE WITH AID OF ELEPHANT

Motion-picture wind machines and an elephant play important parts in testing parachutes at an open-air laboratory near Los Angeles. The chute, attached to a harness worn by the elephant is opened and kept distended by the artificial gale from the big motor-driven propellers. The big four-footed helper is a substantial anchor and the blast is increased to measure the strength of fabric and cords.



Elephant Aiding Parachute Test; Canopy Is Pulled against Blast of Air from Wind Machine to Measure Strength

A Log Cabin Home of Today

LOG-CABIN days are being revived and revised, near Washington, D. C., where a trio of homes built of Canadian cedar and spruce logs are now occupied by contented owners who have used original plans, modern conveniences and forestry products of the pioneering era in the construction of the most unusual mansions built during recent years.

If ever you have lived for a few weeks or a month in one of those charming cedar cabins of northern Maine or southern Canada resorts; you will understand why Dr. S. S. Jaffee and Maj. C. G. Mettler happened to build permanent houses of logs close to the national capital. Both were delighted with the cabins in which they lived during winter and summer vacations spent in the woods. They tested out the timberland cottages during days when the thermometer recorded forty-five degrees below zero and when the mercury soared to peak of summer temperatures. They found neither flaws nor faults in the construction, durability or livability of the log houses.

Hence, for their own homes, one chose cedar and the other spruce in rough log form. In both instances, the amateur builders sought to purchase the raw logs of local dealers. The prices which the middlemen asked were prohibitive. The retail lumbermen wanted from $8 to $10 a piece for logs forty feet long and eight inches in diameter. So Dr. Jaffee arranged to buy his supply on the stump. The logs cost thirty cents each as growing trees, while cutting, skidding to the river, and formation into rafts cost fifty cents more. Rafting to the railroad and freight to Washington brought the total cost up to $2 a log. Had they been dressed into lumber, there would have been an import duty to pay, but there is no charge on logs in the rough. With logs costing $2 each and each log eight inches in diameter, a forty-foot wall, eight feet high, takes but $24 worth of material, making an unusually cheap form of construction.

Nowadays, it is extremely difficult to find an American carpenter who is experienced in log-house construction. The Washingtonians solved the dilemma by importing workmen from northern Maine. These homespun carpenters charged only from $4 to $5 a piece daily and board. The cabin owners were their own architects and designers. The Mettler home more closely resembles those spacious, inviting and comfortable cottages of Maine and the New England woods and mountains. The Jaffee home is a real mansion made of Canadian cedar, most unusual in layout, arrangement and finish.

Most of the rooms in this picturesque

ten-room house are informal and so comfortable and inviting that your tendency is to tarry. To balance these, there are several formal rooms which lend dignity to the attractive home which is illuminated by electricity, heated by an oil-burning furnace, provided with every modern comfort and furnished luxuriously. The logs look as they did in the forest. The bark has not been removed. Cedar bark, unless diseased, remains in position indefinitely. The cracks between the logs were plugged with metal lath, cut to fit and nailed into place. Cement plaster, colored with burnt umber to resemble the cedar bark, was worked into position over the lath to fill all the chinks and crevices.

The house is roofed with cedar shingles which were milled expressly for that purpose. A thick layer of fireproofing and insulating material was laid as a protective blanket between the roof boards and the shingles. The tiny cracks around the doors and windows were plugged with 300 pounds of oakum sealed into permanent position. Dr. Jaffee says the log mansion is so wind-tight and weatherworthy that during the normal Washington winter, windows have to be left open during ordinary weather for ventilation purposes and to moderate the natural temperature.

The mansion has really been built in the style of a house within a house, for the structure was originally built in two sections which, when completed, were combined. A commodious, high-ceiling living room, eighteen by thirty feet in floor dimensions, is the outstanding feature. All the other rooms are lathed and plastered as in the ordinary residence, but the ceiling of this lounge room and library shows the natural logs with roof boards and supports stained a natural cedar-bark color. A large stone-faced fireplace, which accommodates five-foot lengths of cordwood,

Individual Rustic Porches Open from Each Bedroom, Overlooking a Formal Garden, Above, While Below Are Two Views of the Six-Room Cottage, with a Garage on the Basement Floor

Even the Small Cottage over the Garage Has a Big Living Room, Featuring a Massive Stone Fireplace, While All the Doors, Like Those of the Main House, Were Handmade in Ancient Style

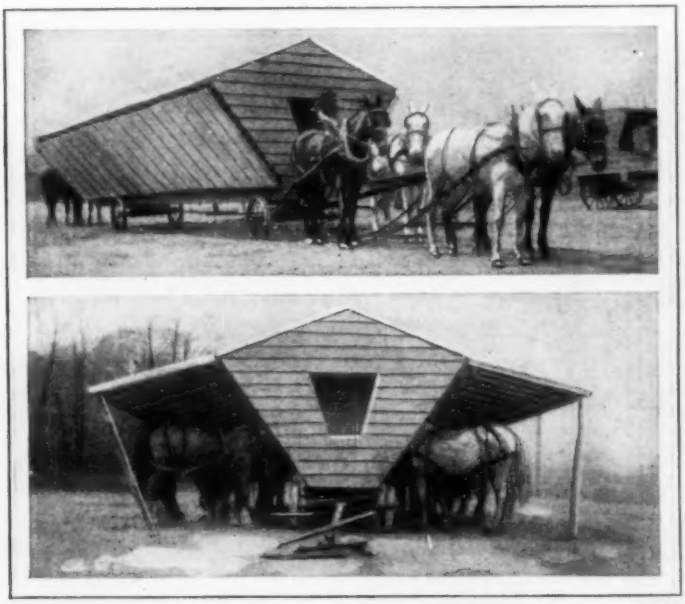
and a music alcove, in balcony form, on the level of the second floor with a rustic log railing are other features.

The main section of the house is sixty-five by thirty-four feet with six rooms on the ground floor and four upstairs. Instead of having a formal dining room, the Jaffees have provided a cozy dining alcove. Whenever they entertain guests, the table is laid in the large living room and library. An interesting feature of the first floor is a suite of rooms which is linked by a corridor with the rest of the house, but which can be shut apart as though entirely isolated. This suite consists of two bedchambers and a connecting bath. Each chamber has a small private rustic porch which overlooks a charming garden.

The house is built on a strong and serviceable foundation of concrete and stone. It is important in such construction to protect the base logs against extreme weathering and fairly rapid deterioration. This is done by building a durable foundation of brick, masonry, tile, concrete or cement blocks. Dr. Jaffee imported only two carloads of cedar logs to build his commodious home. He utilized the surplus material in building rustic fences and porches. His ornamental garden is most attractive as a result of the rustic fence which surrounds it. His cedar mansion is also unique in that the front and rear exposures are interchangeable by a few modifications. The residence was built at the center of a four-acre tract. It lies between two paved avenues. The front of the house is on one avenue grade, while the rear is attractively terraced and beautified, the street being about one story below the ground-floor elevation.

There were enough logs left over after the main house was completed to build a snug and sightly six-room cottage. Originally, its owner planned using the cabin for servants' quarters. People who passed that way, however, were so insistent that the cottage be rented that Dr. Jaffee finally assented.

The Mettler home is built of spruce logs which were "barked" before they were skidded and used for the house.



Barn Closed for Travel and Open; Sides Form Protecting Roofs for the Horses, Which Are Fed from Central Mangers

HORSE BARN ON FARM WAGON AIDS CONTRACTORS

Easily moved from job to job, a portable shelter barn that will accommodate eighteen horses and can be used for hauling hay and grain, has been devised for the special use of contractors who find caring for the teams an expensive and bothersome item. The structure is thirty-six feet long and twelve feet wide when closed. Hinged sections on the sides open out to form the shelters and double the width of the barn. Feed racks and end walls are securely built in.

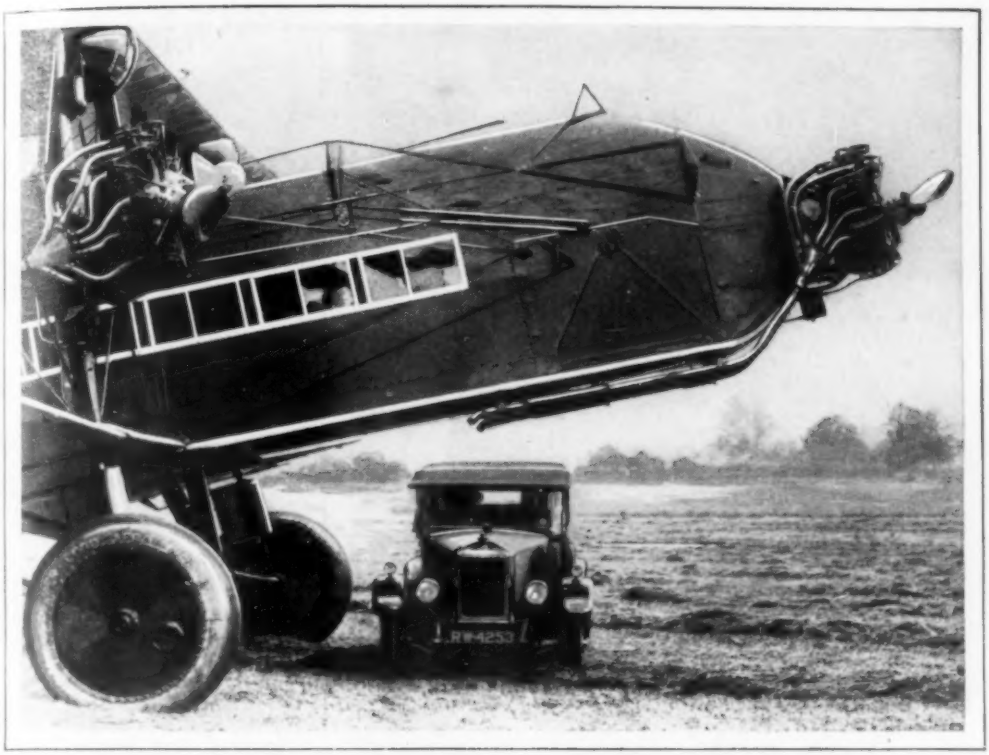
RADIO IN WORLD TEST TO FIND IF CONTINENTS MOVE

Are the continents moving? Observers in more than twenty countries have united in a world-wide survey to find the answer to this question, which is regarded as having important connection with the origin of the great land areas and the changes that have taken place on the earth's surface. Solution of the riddle is being sought by making careful longitude calculations from appointed stations. This involves accurate time measurements. Radio signals sent from powerful broadcasting centers will be recorded at the instant of reception at each observation point, and the measurements made in this survey will be compared with similar observations in 1931, it is planned. If evidence is found to support the theory that the continents move, the measurements and comparisons will be continued.

CEMENT SPRAYER MENDS FURNACE

Brick and tile-furnace settings are quickly coated for further use with a special cement which is applied by a small nozzle sprayer operated under 100 pounds of air or steam pressure. The distributor is controlled by a single valve, is light and compact and easily operated by one man. Carborundum is an essential part of the cement mixture, its heat-resisting qualities affording a durable surfacing. It may be applied to hot or cold settings.

Spraying Cement on Furnace Brick; Flow Is Controlled by Hand Nozzle



Motor Car under Giant Plane Emphasizes the Huge Size of One of the Latest Sky Craft; Motors on Sides and at Front, Three in All, and Accommodations for Twenty Passengers Are Features

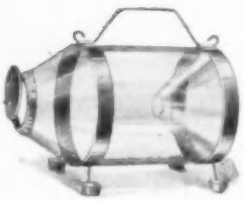
PLANE FOR TWENTY PERSONS HAS THREE ENGINES

Accommodations for twenty passengers and their luggage are provided in a monster airplane launched in England. To reduce the hazards of journeys, it has three engines, to eliminate, as nearly as possible, the need of forced landings. Besides the passengers, a crew of several men is carried.

RECORD OF HEARTBEATS MADE TO HELP TREAT DISEASE

Diagnosis of heart and lung diseases will be simplified and made more accurate, it is expected, through an instrument developed at the university of Pennsylvania. It combines some of the principles of the telephone, the phonograph and sound-amplifying apparatus that was used during the war to detect the presence of undersea craft. With it, records of murmurs in the chest, heartbeats and other sounds are made and these noises are reproduced so loudly that a whole classroom can hear them, it is said. Should comparison be desired in a doubtful case, a record of a diseased condition could be played, showing what noises attend the malady, giving the examiners an accurate guide without the necessity of searching for another patient with such an affliction. The instrument eliminates most of the likelihood of error arising from the human element in using the stethoscope. It is planned to produce the equipment for physicians' as well as classroom and laboratory use.

TRANSPARENT MINNOW TRAP IS EASILY SET



Transparent pyralin forms the sides of a minnow trap now on the market. It is reinforced with galvanized-iron bars and heavy wire, easily carried and set, and is said to have proved practical and efficient.

Elaborate Carving from Split Ivory Tusk; Figures in Full Relief Emphasize Realistic Appearance

SCORES OF FIGURES CONTAINED IN CARVED IVORY TUSK

One of the latest additions to the Victoria and Albert museum in London is an intricate carving from a single ivory tusk, split down the middle. It contains scores of tiny figures, grouped in a tableau to represent the "Assumption of the Virgin." The lifelike appearance of the forms is increased by the fact that they are cut in such full relief as to give the impression of almost complete detachment. It is believed probable that the work was executed by a Spanish or Italian craftsman of the eighteenth century.

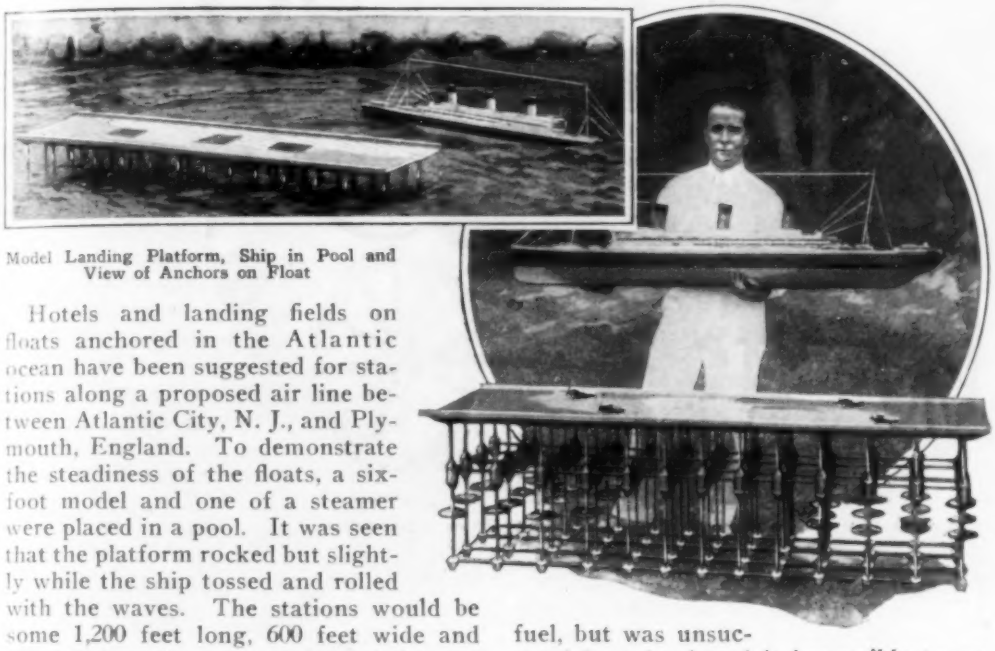
BALTIC SHALE RICH IN OIL

Tests of oil-bearing rock found in the Baltic regions have shown that it contains seventy-five gallons to the ton, of which eighty to ninety per cent can be extracted. This is said to be about twice the possible recovery from American shale. Improved processes of separating the oil at a California plant have enabled the product to be marketed in competition with the well oil. It is being used as fuel for locomotives and for an ore extraction plant. After the shale is mined, it is crushed, heated in large steel retorts and the distilled oil drawn off in storage tanks. Gases are cleansed and cooled and more oil taken from them. The spent shale is made into fire and insulating brick.

SWIVEL-MOUNTED SHAPER-JOINTER WORKS WELL

Operated from a lighting socket, the one-quarter horsepower motor in a combination shaper and jointer is attached to the table by swivels so that the cutters can be set at any angle desired relative to the work. Smaller cutters can thus be used with a consequent saving in power and added safety. The outfit is portable and runs at high speed. It is said to perform well and to produce a high quality of work. It weighs less than nineteen pounds, including the motor.

FLOATING HOTELS IN OCEAN TO SERVE AIR LINERS



Model Landing Platform, Ship in Pool and View of Anchors on Float

Hotels and landing fields on floats anchored in the Atlantic ocean have been suggested for stations along a proposed air line between Atlantic City, N. J., and Plymouth, England. To demonstrate the steadiness of the floats, a six-foot model and one of a steamer were placed in a pool. It was seen that the platform rocked but slightly while the ship tossed and rolled with the waves. The stations would be some 1,200 feet long, 600 feet wide and seventy feet above the surface of the water. Powerful searchlights would help guide the planes, which each would carry twenty-five passengers besides baggage.

COAL DUST FOR DIESEL ENGINE TESTED IN GERMANY

Successful experiments at running a Diesel engine on powdered coal are reported from Germany. One unit was operated several thousand hours under test. Coke slag and ash formations in the cylinders were removed by combustion gases and the problem of introducing the coal dust into the cylinders against high pressure was also solved. Special construction kept the powder from getting into the lubricating oil. Rudolf Diesel, the inventor of this type of engine, is said to have expected to use powdered coal as well as oil and other liquids for fuel, but was unsuccessful, as he found it impossible to accomplish complete combustion of the coal in the short time available. In spite of the encouraging results of these last tests, engineers declare that coal will not be practical until a motor is designed that will take any kind rather than the prepared fuel used in these experiments.

LENS FOR BIG AERIAL CAMERA WEIGHS FORTY-FIVE POUNDS

American lens makers demonstrated their skill in preparing the huge "eye" for a camera constructed for the U. S. air service. It weighs forty-five pounds and is said to be the largest camera lens ever ground in this country. With the mounting, it measures nine by nine inches and has a focal length of thirty-six inches. It will take pictures of entire cities at one exposure.

Lens of Huge Camera Compared with Small Pocket Kodak to Illustrate Size

One of the First Automobiles Ever Made in the United States, a Steam Carriage That Is Still in Use in Sayler Park, Ohio

Your

By HAROLD

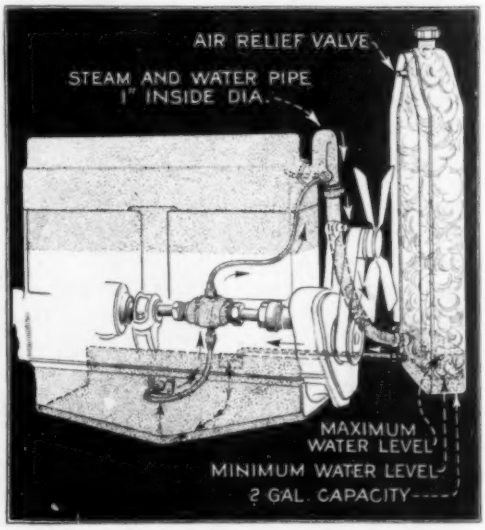
UNQUESTIONABLY the most interesting thing about the automobile is its ever-changing features. It is never quite the same two years in succession. It is continually exhibiting something new to interest motor-car owners.

In just the past two or three years such important improvements as four-wheel brakes, balloon tires, air cleaners, oil filters, lacquer finish and all-steel bodies have been added. What next?

The answer to this question is likely to disclose the most radical development since the automobile was first conceived, and the answer is this: Smaller and lighter cars are going to be manufactured. These cars will give thirty to fifty miles on a gallon of gasoline and will be capable of doing almost anything larger cars can do. Already one American manufacturer has announced such an automobile, and it is understood that between now and the first of the year there will be several others.

This statement alone is of interest, but in addition there are indications that this small-car development will eventually influence big-car construction with the result that the automobile of the future will be smaller and more economical, yet just as comfortable and capable as the common run of cars built today. In short, it appears that automobiles of all capacities will be scaled down in size and weight, with corresponding improvement in fuel, oil and tire economy.

The trend toward smaller cars began several years ago in Europe. Over there a 2,500-pounder is now popularly considered a large car, and it is, compared with the average European automobile, for many foreign cars weigh only 1,000 to 1,500 pounds and some weigh as little as 600 pounds, while the smallest closed bodies weigh as little as 120 pounds. As a rule, four-cylinder engines are used with piston displacements ranging from forty to about 100 cubic inches, whereas, in comparison, the Ford is a monster with a displacement of 176 cubic inches. Maximum speeds of these cars range from forty to eighty miles an hour, fuel economy from thirty to sixty miles per gallon, and passenger capacity



Steam-Cooling System That Gives Greater Efficiency and Reduces Size of Radiators

Next Auto?

F. BLANCHARD

One of the Smallest Cars Ever Made; It Weighs Only Six Hundred Pounds and Has an Air-Cooled Motor

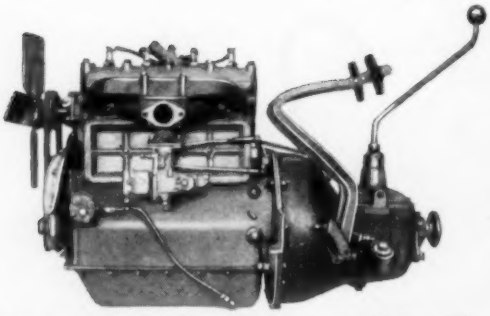
varies from two to five persons.

The development of attractive, roomy, well-built, powerful, high-efficiency automobiles in the 100-inch wheelbase class is rather certain to influence the construction of cars of every size and price. And, in passing, it should be pointed out that there seems to be little connection between size and performance. A small car can be built to ride almost as well as a large car, and its top speed, its road-holding ability, and other features, may come close to equaling those of the large car. In fact, the very large ones seem to have as many disadvantages as very small cars. The big car is, of course, difficult to handle in traffic and it also may be clumsy on the road. Usually it does not act as well on turns as smaller cars. A rough proof of this is that racing cars are usually built with wheelbases of about 100 inches.

All of which leads up to the view that there is no particular sense in building automobiles bigger than they need be. This view was recently expressed by no less an authority than Thomas J. Litle, president of the Society of Automotive Engineers, who said that there was no good reason for building a two or three-ton car to carry two passengers or more; that present designs were crude and should be discarded; that because a car was high-priced was no reason why it should be overweight.

In order to give a more detailed picture of what Mr. Litle was driving at, as well as to give an idea of what the future may bring forth, it is necessary to look at the modern racing car. The speedway has always been a testing laboratory for the refinement of features which eventually were placed on stock passenger cars. Racing construction in the past has always been several years ahead of passenger-car construction, and if this has held true in the past, there is some reason for believing it will be true for the future also, and that racing-car features of today should be the passenger-car features of tomorrow.

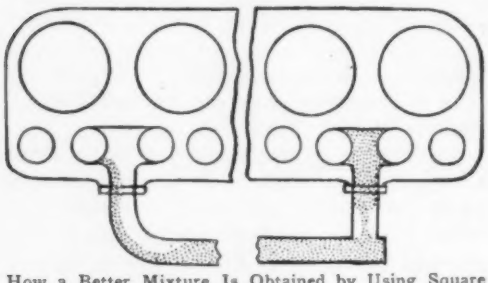
It is significant that the size of racing-car engines has grown steadily smaller. In the early years, racing engines had piston displacements of 1,200 cubic inches or more and developed about 200 horsepower. For the past three years the displacement has been 122 cubic inches, while, this year, the limit was cut to ninety-one cubic inches. Yet racing-car speeds have gone steadily upward, although weight has been reduced but slightly. Time was when a



American Light-Car Engine of Only 131 Inches' Displacement, Which Gives Speeds of over Sixty Miles

1,200-inch engine gave 200 horsepower. Last year racing engines of one-tenth this were yielding the same horsepower, while this year the ninety-one-cubic-inch engines are delivering 150 horsepower.

How did this happen? How is it possible for horsepower to go up as engine size goes down? The answer is better engine design. As engine size has gone down engine speed has gone up. The big engines of bygone days had a maxi-



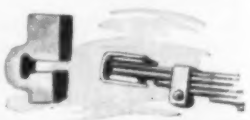
How a Better Mixture Is Obtained by Using Square instead of Rounded Gas Passages

mum speed of about 1,200 revolutions per minute whereas the racing engines in use today run at 7,000 revolutions. To run even a small engine at such enormous speed means that pistons, cylinders, connecting rods, crankshaft and all other parts must be carefully made of the very finest material. It means also that they must be most precisely balanced, bearings nicely calculated to stand the strain and lubrication must be unfailing.

Illustrating Combustion in Cylinders, from Left to Right, Too Lean, Correct Mixture and Too Rich

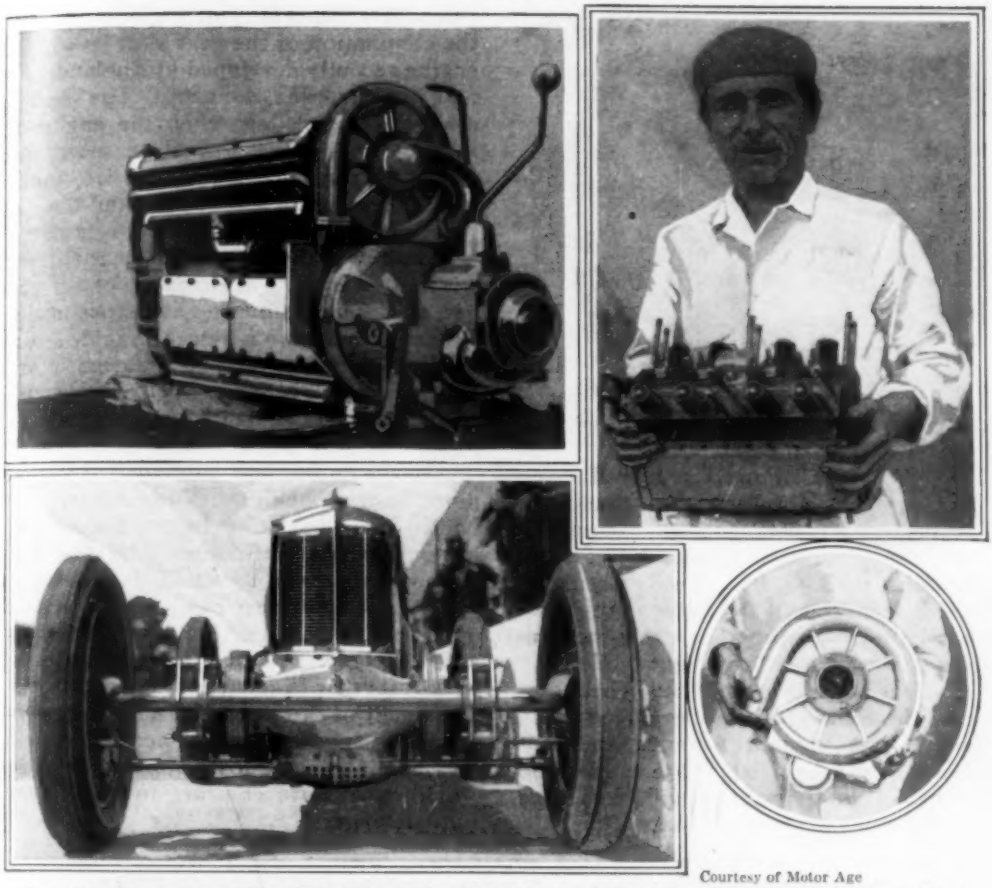
Probably the greatest problem in the modern racing engine is the valves. At 7,000 revolutions, each valve opens and closes fifty-eight times per second. The wonder is that they stand up at all at such terrific speed, and it is difficult in a long race. Each cylinder also has to receive fifty-eight charges of fuel each second. Experience has shown that the suction of the piston in itself is insufficient to adequately fill the cylinders in the fraction of time available. For such speedy work it is necessary to assist piston suction by adding a supercharger, which is nothing more nor less than a pump in the intake manifold that helps force in more mixture than the pistons can draw in.

Because of valve breakages at these excessive speeds several racing-car engine builders are experimenting with the two-cycle system. One car with such an engine was started in the last Indianapolis race. While it did not have the speed of the more highly developed four-cycle cars it gave promise of interesting results when the design has been more completely developed. For those who are not familiar with the two-cycle engine it may be well to explain the difference between the two-stroke cycle and the four-stroke cycle. In the latter, the piston makes four strokes for each explosion, two up and two down, namely, suction, compression, explosion, exhaust. In the two-stroke, the piston makes two strokes, one up and one down, for each explosion. The suction and exhaust strokes are eliminated. In its simplest form, the engine has no valves but the piston uncovers two ports or openings in the cylinder walls at the bottom of its stroke. One is the intake port and the other is the exhaust port. When the exhaust port is uncovered, some of the exhaust shoots into it. An instant later the intake port is uncovered, and the mixture is forced into the cylinder, the incoming charge helping to force out the remaining exhaust gas.



Rubber Block Which Replaces Spring Shackles and Bolts, Needs No Oiling

Not only is the two-cycle engine appealing for racing because of the elimination of poppet valves, but also because it gives twice as many power strokes as the four-



Courtesy of Motor Age

One of the Pigmy Front-Wheel-Drive Racers, Capable of Speeds of More Than One Hundred Miles an Hour; the "Blower" or Supercharger Is Shown at the Lower Right and the Motor Block Above

cycle engine, a feature that becomes increasingly important as engine size decreases. It is therefore of especial interest to learn that a well-known Italian automobile manufacturer has already built a two-cycle ninety-one-cubic-inch engine which has developed a speed of 11,000 revolutions, and yet even this does not seem to be the limit of engine speed.

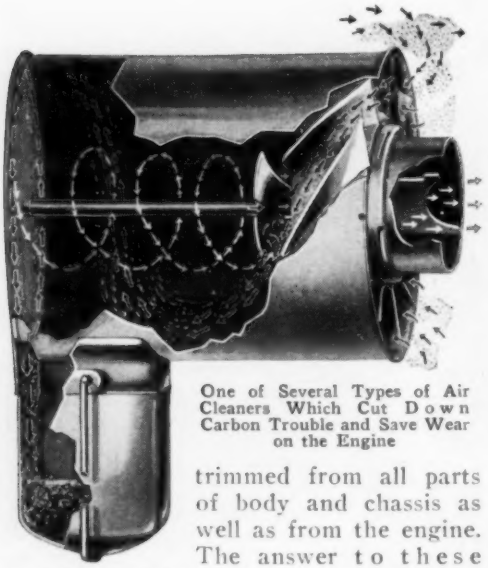
In view of this, it would not be surprising if the ninety-one-cubic-inch four-cycle engines of the future developed double the speed and double the power of present engines, or 300 horsepower instead of 150. Then, if two-cycle engines are brought to the same standard of efficiency, this power will be doubled again, which means that 600 horsepower will be obtained from a ninety-one-inch engine.

If this happens, how large an engine would be required to develop thirty horsepower? Such an engine would be one-twentieth the ninety-one-cubic-inch engine or four and a half cubic inches—about as big as a wine glass. This possibility is far in the future. It may never happen, yet the thought is interesting.

But what of the immediate future? Since a ninety-one-cubic-inch engine will yield 150 horsepower, is it not an interesting possibility for a high-grade, low-weight passenger car?

And if such an engine is suitable for a high-priced small car, why would not a little smaller, slightly slower-speed engine of similar design be ideal for a slightly smaller medium-priced car?

With such small engines, it would be quite feasible to build cars with bodies amply roomy for five passengers and still not have a wheelbase in excess of 120 inches. Weight, of course, would be



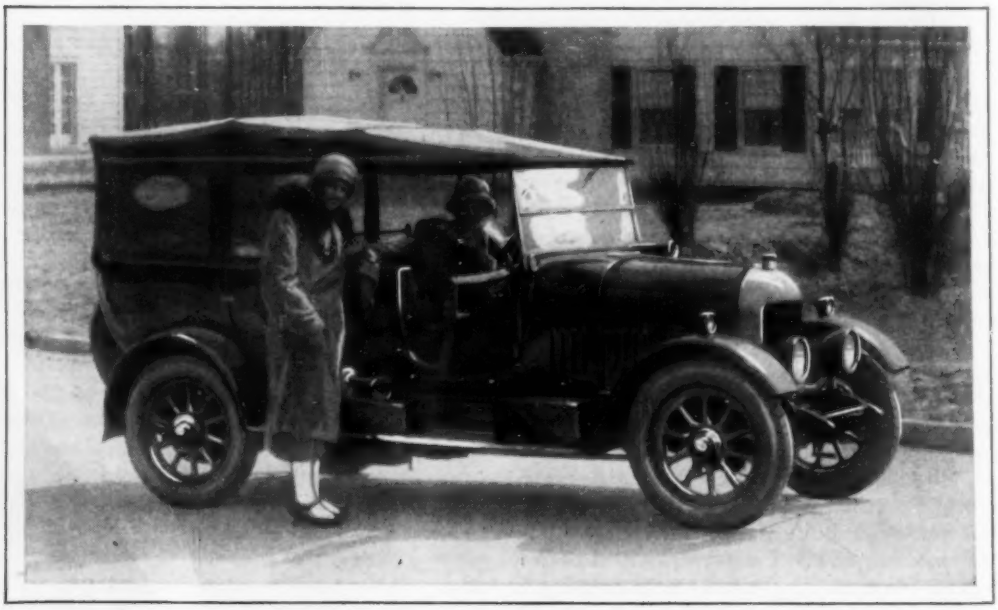
One of Several Types of Air Cleaners Which Cut Down Carbon Trouble and Save Wear on the Engine

trimmed from all parts of body and chassis as well as from the engine. The answer to these questions, perhaps, has already been furnished by Europe. Over there are found stock cars with ninety-one-cubic-inch engines with top speeds of eighty miles.

There is some evidence that lighter cars along these lines will be developed in all price classes here in America and that these cars will be vastly more economical of fuel, oil and tires and will have even more ability than present cars.

Another important step in the offing is the elimination of the gear shift lever. An engine recently developed in England, and now in production, does this. The shaft is always engaged, but when the engine is idling, turning over at slow speed, no power is transmitted, and the car stands still. Step on the accelerator, and the engine speeds up and begins to transmit power, slowly at first, so that the car starts without a jerk. Take your foot off the gas, and the car slows up and stops again. When you come to a hill, the engine automatically speeds up and delivers more power, and when you top the rise and start down the incline it slows down again.

An equally important trend in this country is the movement toward better and more lasting bodies. Many closed car bodies wear out long before the engine has outlived its usefulness. The reason is the constant strain to which they are subjected. One engineer has proposed a pivoted type of construction that will eliminate the body strains. Adjustable seats, back rests that slide up and down with the movement of the passenger's body, easier-operating clutches, and possibly compressed-air or other form of power brakes, all promise more comfort to the driver and passengers.



An English Light Car Capable of High Sustained Speed with a Small Motor, Which Is Notable for Its Great Economy of Operation

THE MYSTERY OF LOST COMETS

Ensor's comet, discovered in 1925 and slated to return in the northern heavens early this year, disappointed the astronomers. It failed to appear, so the observers added it to the list of fiery travelers, that, like some ships of the sea, have been mysteriously swallowed up and never seen again. Biela's comet, found in 1826, kept a regular schedule for several years, then suddenly broke in two. The parts were last observed in 1852, but twenty years later, when the earth was crossing the path of the comet, a remarkable shower of shooting stars came from that part of the heavens which would have been occupied by the comet had it been visible. After Lexell's comet was discovered, in 1770, predictions were made that it would return every five years, but it was never seen again. It was the same with the comet found by Peters, in 1846, Stephens' comet in 1867, and De-Vico's, which should have been visible in 1921 after an absence of seventy-five years, but could not be found. Two main reasons are given for these disappearances. The comets literally waste away or are thrown out of their normal course when they pass too near some great planet.

GOLDFISH AID ELECTRIC PLANT BY DEVOURING MOSS

Now the goldfish enters the ranks of man's dumb servants. Spray ponds where water is cooled at small transforming stations along electric transmission lines, are being kept free from clogging moss by stocking them with the sparkling fish. An interesting balance in numbers and food was maintained at one pond. When the moss was exhausted, some of the goldfish turned cannibals and devoured the others. The survivors kept the vegetable growth from accumulating around the nozzles.

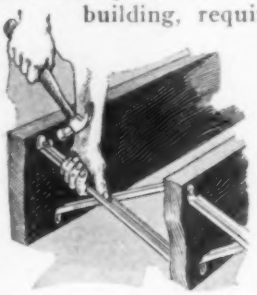
Instructing a Group of Happy Players in the Latest Ship Sport, Deck Archery; It Is Recommended as Means of Avoiding Seasickness

ARCHERY GAME ON SHIPBOARD LATEST DECK SPORT

Keeping the mind pleasantly occupied is recommended as a means of warding off seasickness, and one of the sports offered for this purpose is deck archery. The equipment is essentially like that used on land. A canvas backstop catches stray arrows. The sport is not an easy one even on land, and the movements of the ship afford additional opportunity for the archers to show their skill.

STEEL BRIDGING FOR JOISTS SAVES TIME IN BUILDING

In place of wooden units, steel bridging between joists is said to save time in building, requires about half the nailing and cannot split or crack. Furthermore, better floors are assured as the steel will not warp, and additional safety is secured as the bridging is fireproof. The members are ready for installation, saving the time and expense of cutting and fitting.



MICE DANCE IN MODEL "HOTEL" TO AMUSE SPECTATORS

Glass-Walled Model Hotel in Which Dancing Mice Caper for the Entertainment of Shoppers

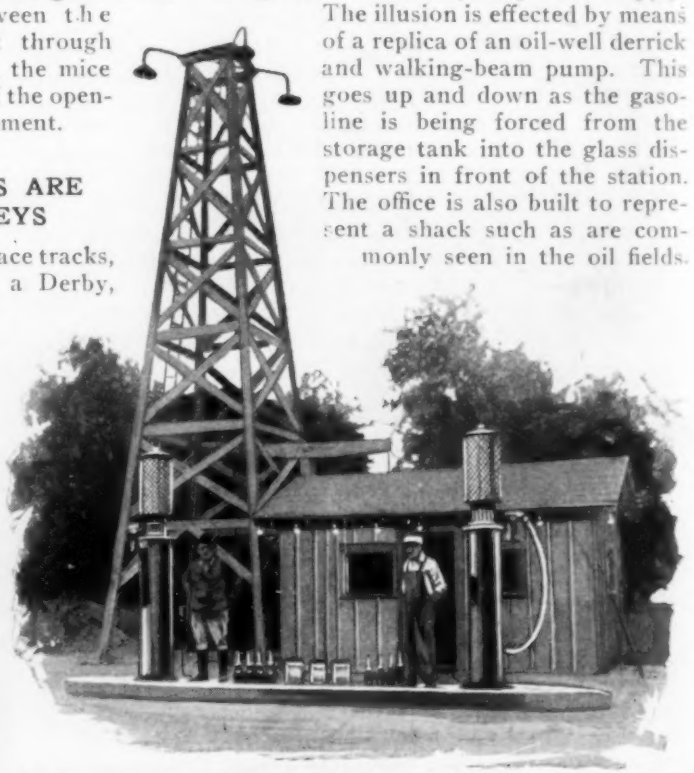
To exhibit a collection of fifty Chinese dancing mice, a San Francisco man constructed a model hotel with a glass front and glass partitions between the rooms. Holes were cut through these walls. At intervals, the mice dash in circles in and out of the openings, causing great amusement.

WHY GAY COLORS ARE WORN BY JOCKEYS

Few frequenters of the race tracks, watching the winning of a Derby, know that the brightly colored silk shirts and caps that the jockeys wear probably had their origin nearly 400 years ago and that the use of different colors is the result of a close race run in 1727 which the judges had difficulty in deciding as all three jockeys "rid in yaller." In 1530, King Henry VIII of England listed expenses of making doublets "for the running boys of the stabul," and for "ryding cappes of blac satin," an item paid to the "mylanner" (milliner). From this record, it appears that the king was the first to dress his jockeys in colors. In 1762, thirty-five years after the confusing race in which the three yellow-clad riders participated, the Jockey club passed a resolution compelling owners to adopt jackets and caps of a particular color for their separate use. The custom has persisted since that date. The duke of Devonshire's straw-colored jacket and cap, selected then and still in use, have figured as winners in many a race up to the present time. Nowadays, if an owner runs a horse under colors other than those registered in his name, he must make a declaration of his plan to the clerk of the course before the race starts, otherwise he is subjected to a heavy fine.

DERRICK AT FILLING STATION REPRESENTS OIL WELL

Patrons of a gasoline-filling station in an Ohio town may form the impression that the fuel is being pumped directly from the ground when they stop for a supply. The illusion is effected by means of a replica of an oil-well derrick and walking-beam pump. This goes up and down as the gasoline is being forced from the storage tank into the glass dispensers in front of the station. The office is also built to represent a shack such as are commonly seen in the oil fields.



An Innovation in Filling-Station Architecture; the Derrick's Beam Pump Actually Runs When Cars Are Filled

Looking Down on the Political Heart of America from the Dirigible "Los Angeles," Part of the Ship Showing in the Upper Left Corner; Low Altitude and Slow Speed Aided the Photographer

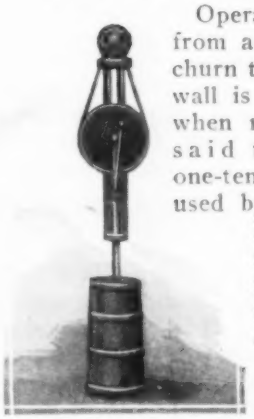
AERIAL VIEWS OF WASHINGTON SHOW CAPITOL'S POSITION

Keeping in mind the relative location of important government buildings in Washington has been simplified for the visitor by means of aerial photographs. Several taken by the navy department recently from the dirigible "Los Angeles" are considered especially informative, as the craft was not at a great altitude, and consequently details and landmarks in the pictures are more easily identified.

VIKINGS VISITED THE FAR WEST ROCK INSCRIPTIONS SHOW

That the Norsemen had been in America long before Columbus is further indicated by a story of a battle between Vikings and Indians, inscribed on a bowlder near Spokane, Wash. The inscriptions were believed to have been the work of Indians, but recently, Prof. Oluf Opsjon, an authority on Norse history, translated them and declared them to be records in runic characters of a fierce struggle in which a party of twelve Norsemen had escaped from the red men after an equal number of Viking warriors had been killed and six of the seven women captured. The survivors returned later and wrote the story. Many of the characters were covered with moss, and its removal is expected to reveal further inscriptions. The scientist places the incident at about 1010 A.D.

ELECTRIC CHURN FITS ON WALL PUMPS WATER AND TIRES



Operated by electricity from a lighting socket, a churn that fits against the wall is out of the way when not in use, and is said to consume about one-tenth of the current used by an electric iron. It may also be used for pumping water, for inflating tires, turning an ice-cream freezer, and for various other similar purposes. The length of the stroke may be easily regulated without moving the churn.

Launched with a Pat from a Monster Powder Puff; Scene at a Yacht Christening

POWDER PUFF FOR CHRISTENING REPLACES CHAMPAGNE

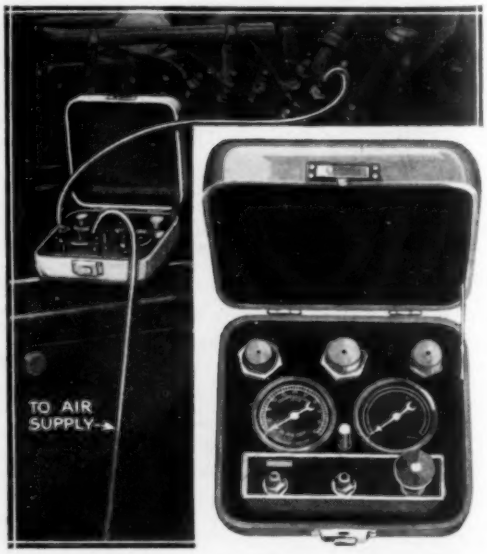
Boat-christening procedure was varied somewhat at an eastern launching, when the young woman sponsor patted a huge powder puff against the nose of a trim little yacht instead of breaking the formerly customary bottle of champagne. The novel departure was considered appropriate in preparation for a journey and several members of the boat club had voted against using wine.

HINGED "SKIRT" ON STREET CAR DEADENS NOISE

Constructed of light-gauge metal and lined with an insulating lumber, a twelve-inch "skirt" around the substructure of a street car in use in a Michigan city, is said to absorb much of the noise and also improves the appearance of the car, as it hides most of the trucks and wheels. It is on hinges so that it can be raised for inspections. Besides this feature, the car has an insulated and rubber-covered floor and in the wheels are rubber pads which help deaden the noise.

METER FOR AUTO COMPRESSION SHOWS CAUSE OF LOSS

Loss of compression and the cause, whether due to cylinder trouble or valve leakage, are determined with a simple meter without dismantling the motor. The results are obtained by passing compressed air through the instrument and then on into the cylinder being tested and out through any leaks that may exist. The percentage of such loss is accurately registered on a gauge, enabling the tester to determine the size of the leak and to identify a scored, warped or otherwise faulty cylinder. To make examination for valve leakage, the procedure is practically the same, except that the top of the piston is sealed with heavy cylinder oil. Subtracting the amount of valve loss, if such is shown, from the total loss revealed by the first test, leaves the amount of piston leakage. The meter is simple to use, is easily attached to the cylinders after the spark plugs have been removed and has a signal whistle to indicate when the piston is beginning its compression stroke, the proper position for making the test.



Meter in Position for Use and View of Top of Instrument Showing the Registering Dials

Behind the Scenes at the Zoo

Chimpanzee Rates Highest in Intelligence, While Elephant and Domestic Horse Are Tied for Second Place, with Lion Third

By FLOYD TAYLOR

IN one of the thick albums of Edwin R. Sanborn, official photographer, there is a fine picture of the deadliest snake in the New York Zoological society's collection, the jararaca-cu.

To get this photograph Mr. Sanborn spent an hour alone with the infuriated snake. The jararaca-cu is not accustomed to photography, and it is worth any man's life to go near it carelessly. It can strike two-thirds of its own length and its victims have only from ten minutes to half an hour to live unless anti-venom serum can be secured. Twice Mr. Sanborn was within range of the snake, within about three feet of it, when it hurled itself toward him and buried its fangs in the camera cloth as he stepped aside. Mr. Sanborn paid little attention to the snake's hisses. For twenty-five years he has been photographing everything from elephants to little ground hogs, and he has taken about 5,000 pictures of birds, animals and reptiles, including those of the most deadly snakes and the most ferocious beasts.

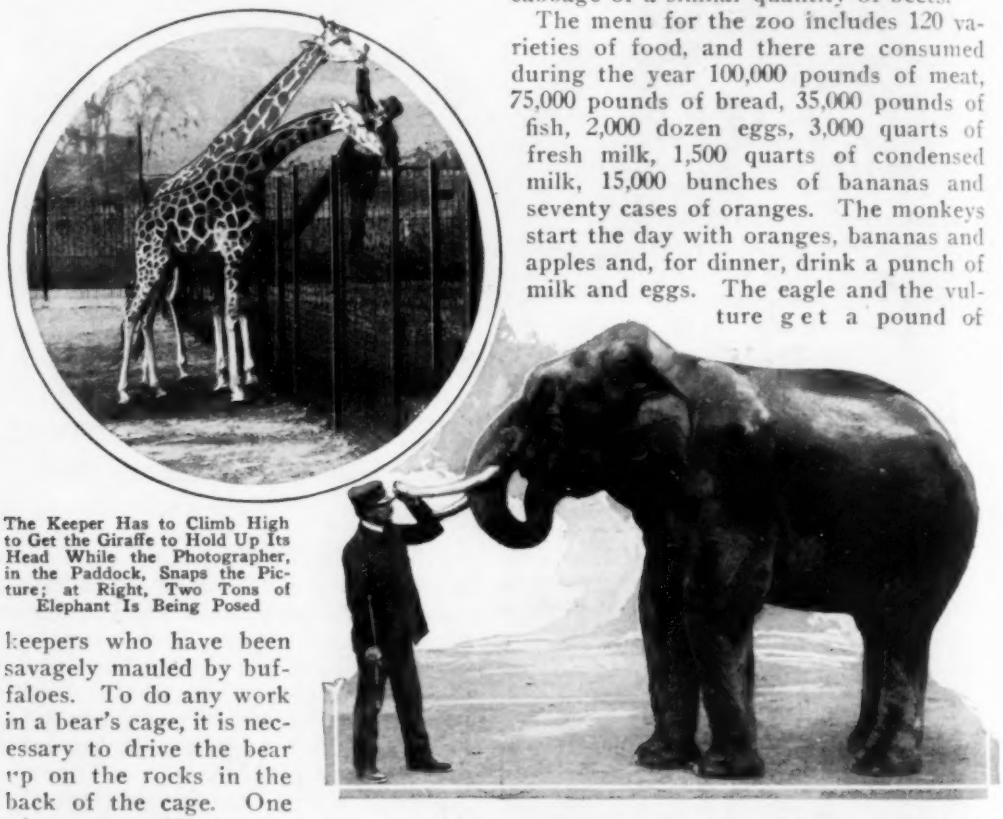
An hour passed while the jararaca-cu rippled on the floor. Occasionally Mr. Sanborn clicked the shutter of the camera and then changed the plates. Finally he was satisfied, and the snake was put back in its cage while the photographer developed his pictures.

John Toomey, head keeper, says that the only safe assignment in the zoo is caring for the lions, tigers and other jungle cats. The cages of these are divided in two parts and, while a keeper works in one, the cat is in the other.

"There are marks on several of our keepers," he said, "which prove their work is dangerous, with more risk in it than might be supposed. Animals that have been quiet for years will make a sudden attack and the keeper is unprepared.

"In certain months the animals are more dangerous than in others. Elks are likely

to be troublesome from August to February, their mating season, when their antlers are tough and pointed, and they resent the intrusion of the keepers. I have seen an elk plunge against the gates with enough force to knock them from their hinges. The buffaloes must be watched carefully. Their method of attack is peculiar. With their great power and surprising speed, they roll men along the ground with their heads, bucking viciously. I recall at least two instances of keepers who have been savagely mauled by buffaloes. To do any work in a bear's cage, it is necessary to drive the bear up on the rocks in the back of the cage. One of our men, while in a cage, turned to find a gigantic brown bear leaping on him. He threw up his hands and attempted to dodge past the bear. He got by, but his hand was badly cut. Gangrene set in, and it had to be amputated.



The Keeper Has to Climb High to Get the Giraffe to Hold Up Its Head While the Photographer, in the Paddock, Snaps the Picture; at Right, Two Tons of Elephant Is Being Posed

"After the animals have been in the zoo for a time, they are less dangerous than when they first arrive. When they become used to their surroundings and find the keepers have no intention of harming them, they can be approached in comparative safety."

The biggest eater in the zoo is the African elephant, "Khartoun." It weighs 10,000 pounds and every day consumes 125 to 150 pounds of hay, thirty pounds of carrots or beets, fifteen loaves of bread, and drinks ten to fifteen gallons of water. "Alice," its companion and rival for eating honors, drinks water directly from the hose and thus conceals her gallon capacity. The hippopotamus manages to live and prosper on a ration of 100 pounds of hay, ten loaves of bread and ten heads of cabbage or a similar quantity of beets.

The menu for the zoo includes 120 varieties of food, and there are consumed during the year 100,000 pounds of meat, 75,000 pounds of bread, 35,000 pounds of fish, 2,000 dozen eggs, 3,000 quarts of fresh milk, 1,500 quarts of condensed milk, 15,000 bunches of bananas and seventy cases of oranges. The monkeys start the day with oranges, bananas and apples and, for dinner, drink a punch of milk and eggs. The eagle and the vulture get a pound of meat a day a piece, and the ostrich has half a peck of lettuce or crushed oats.

The python, which is twenty-two feet six inches long, supports its length on a dinner once a month of thirty to fifty pounds of mice, rats, chicken and guinea pig. A meal for it costs $8. The sea lion thrives on seven pounds of fish a day.

Pythons are cheap; they can be obtained for from $300 to $400 a piece. Macaws bring from $300 to $1,200. "Khartoun," who was bought for $1,200 when it was very young, is worth $25,000 now

Asking a Ton of Hippo to Open Its Mouth, So the Photographer Can Get a Nice Picture of Its Teeth, Is Only One of the Jobs a Keeper around the Zoo Is Called On to Perform; in the Circle, a Russian Brown Bear Is Being Persuaded to Stand Up Nicely on Its Hind Legs and Act Friendly While the Cameraman Clicks the Shutter; from Constant Handling Many of the Wild Animals Become Quite Tame

The Dentist Who Undertakes to Cure an Elephant's Toothache, Acquired from Eating Too Much Candy and Peanuts, Literally Has His Hands Full While He Fills a Pachyderm-Size Tooth; Above Is a Mule-Deer Fawn Being Raised on a Bottle at the Bronx Zoo in New York; Keepers Must Know Many Things, Including How to Be a Mother to Young Animals

that it is full-grown. Ostriches cost from $25 to $500 a pair, eagles and vultures from $10 to $200 a piece; birds of paradise from $200 to $1,000, an Indian rhinoceros $8,000, and pygmy hippopotamuses about $5,000.

Dr. William T. Hornaday, former director and general curator of the zoo, says the chimpanzee is the most intelligent animal in his care. In the scale of intelligence, he gave the chimpanzee 925 points, the Indian elephant 850, the domestic horse 850, the lion 725 and the rhinoceros 175. The zoo's smallest mammal is from Egypt. It is the jumping rat, or jerboa, which looks like a miniature kangaroo. The smallest bird is the strawberry finch and the rarest mammal the giant tapir, which is only a third grown and weighs 800 pounds. It was captured in Panama.

One of the most difficult tasks in the zoo is that of Dr. W. Reid Blair, who cares for sick and injured animals. He often has to treat monkeys for tuberculosis and sea lions, which were brought to the zoo from the frigid waters of the Pacific, for pneumonia. The tiger sometimes gets a toothache and the elephant develops enormous corns, which must be trimmed. The delicate bones of the deer and antelope are snapped as they race in their fields and must be set as carefully as the fracture of a man's leg.

The more hardy animals at the zoo live in the open all the year round, and herds, like those of the buffalo and wild horse, have large pastures. In the winter, the tropical birds live in a steam-heated house.

Mr. Hornaday says most of the animals are as happy as a man, who had struggled for years to make both ends meet, would be if he was suddenly installed in a fine hotel where someone else paid his bills.

"Care given to the animals," he said, "extends the life of many of them far beyond what they would expect in the merciless jungle. One of the leopards lived to the ripe old age of twenty-one. It had not a tooth in its head at the last, to be sure, but it was kept alive all the same with plenty of chopped beef.

"Then there is our polar bear, 'Silver King,' now twenty-three years old. It is hardly conceivable that it could have lived so long had it been left to face its enemies and the rigor of the Arctic winters."

An African Lion, as Much Interested in the Work as the Young Sculptor, Who Is Trying to Perpetuate Him in a Plaster Model, from Which Bronze Ornaments May Later Be Cast

PLANES HUNT BUGS TO CURB PLANT DISEASE

Bug hunting by airplane, to help rid the country of plant pests, such as rust, enemy of wheat crops, and other diseases is proving effective. On a wing of the plane is a little box containing glass slides covered with vaseline. As the ship rushes by, dust particles are collected on the surfaces and after landing, the hunters, who are trained scientists, seek through the "catch" for the little spores, the parasites that lodge upon wheat stalks and take the moisture and soil food that the grain needs. One of the objects of the hunting is to find out how far the spores travel and where they start. Planes are up on suitable days all the way from Texas to Minnesota. Already the hunters have found that the barberry bush is a prolific breeding place for rust. It is said that one bush in Indiana cost the farmers within a radius of fifteen miles a loss in crops of $12,500 a year. The spores are only one five-thousandth of an inch in diameter, travel at high altitudes and with the speed of the wind. This season, the aerial bug seekers were anxious to find out if the rust which had appeared in Mexico and in Texas had traveled as far north as Minnesota.

The Popular Mechanics' Bureau of Information offers its free service to all readers of our magazine. Names and addresses of manufacturers and dealers in articles described, and any other details in our possession will be promptly furnished.

Adaptation of an Ancient Egyptian Figure to a Modern Monument; Veiled Sphinx at Base of World War Memorial in Kansas City, Missouri

SPHINX UNDER VEIL OF GRIEF GUARDS WAR MEMORIAL

Veiled under a shroud of stone as though in perpetual grief, the figure of a sphinx has been carved at the base of the memorial to soldiers of the World war in Kansas City, Mo. The emblem was chosen as expressive of eternity and mourning.

HOLES FOR SWITCH BOXES CUT IN LESS THAN A MINUTE

Driven by an electric drill or a hand brace, a cutter for making wiring outlets in plaster or wood, is said to finish a hole for a switch box in less than a minute when the drill is used and in about three minutes with the brace. The operation is performed by four saws placed in such a way that each one cuts one side of the opening. The tool is attached to the wall at the place where the hole is wanted with screws and then the drill or brace connected.

Cutter Used with Hand Brace, and Opening Made in Wall for Electric Switch

Borah and Hagenlacher at the Starting Line; the Billiard Ball Led at First, but Was Beaten at the Finish

SPRINTER RACES BILLIARD BALL IN NOVEL SPEED CONTEST

Can a sprinter run faster than a billiard ball rolls from the stroke of a champion player? To answer the question, Charles Borah, freshman at the university of southern California, pitted his speed against that of a ball driven by Eric Hagenlacher, balkline-billiard champion. The distance was seventy-five yards. For three-quarters of the way, the ball was in the lead and then friction got the best of its momentum, allowing Borah to finish ahead.

METAL STRIP TO HANG PIPE OF ALL SIZES

For hanging lengths of pipe from ceilings, steel tape, in handy reels of 40 or 100 feet, can be adjusted to fit conduit of any diameter, eliminates waste and requires no bolts. It is looped around the pipe, bent so that the end can be drawn through a narrow slit in the strap and secured by means of a cotter pin inserted through the two holes along the edges of the tape.

BRIGHT WRAPPING SELLS GOODS

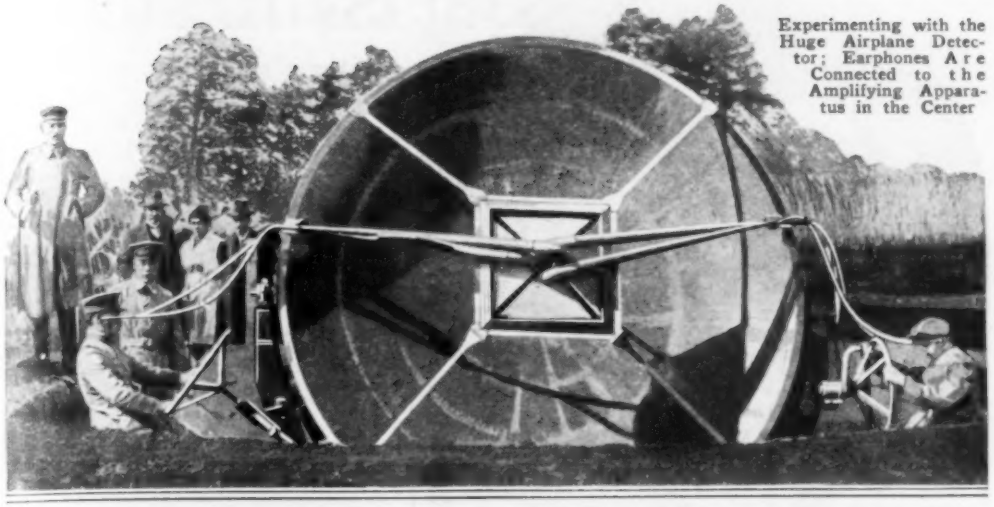
Exporters have found that the color of the labels on their merchandise is an important factor among peoples of several foreign countries. In West Africa, wrappings with gaudy pictures of birds, beasts and fish help sell cloth. The Hovas of Madagascar prefer guns with highly ornamented stocks and bicycles painted with bright aluminum. South American natives are also fond of gold and silver paint. Chinese are particular in regard to colors. Green and white to them are indicative of mourning and must be avoided on packages, but red, yellow and gilt papers are popular, as they are also in India. Chinese buyers are especially concerned about tinned goods and will reject a whole shipment if a label is blemished, it is said.

SAFETY RAZOR THAT FOLDS UP FITS VEST POCKET

With finger grips instead of an ordinary handle, a safety razor that can be slipped into a small leather case and carried in the vest pocket is a convenience while traveling. The grips fold flat when not in use, and are placed close to the cutting edge to steady the razor while shaving.

WHAT BECOMES OF OLD TIRES YOU THROW AWAY

Thousands of discarded automobile tires are purchased from garages and shops and sold to vulcanizers or rebuilders at prices ranging from fifty cents to $5 each. Boots are made from old casings and some revenue is obtained from tire fabric of suit-



Experimenting with the Huge Airplane Detector; Earphones Are Connected to the Amplifying Apparatus in the Center

able length. According to one dealer, not more than five per cent of reclaimed rubber can be mixed with the crude in making new tires, for a larger amount will degrade the product. Chemists are experimenting with processes to restore life to old rubber and thus make it practical to use a large percentage. Inner tubes of the better kinds may reappear as rubber gloves or heels, while inferior qualities are used in matting and roofing. Not long ago, when prices for old rubber were high, enterprising junk dealers collected so much of it that, in a short time, 1,000 carloads of the material accumulated in the railroad yards of one Ohio city.

COURSES IN NAVAL TRAINING OFFERED IN UNIVERSITIES

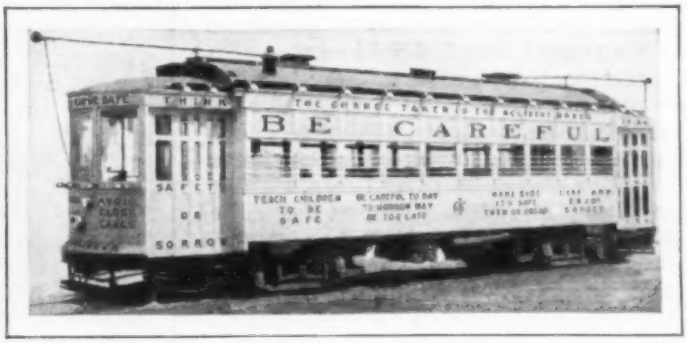
Steps are being taken to establish naval-training units at Harvard, Yale, Georgia Institute of Technology, Northwestern university, and the universities of California and Washington. A four years' course in naval science and tactics will become effective in these schools at the opening of college this fall. Students will receive the same training as midshipmen and will be eligible for junior-officer commissions in the naval reserve.

MONSTER "EAR" TO FIND PLANES DEVELOPED BY JAPANESE

Shaped somewhat like a gigantic ear, an amplifying apparatus devised by Japanese army experts is said to have proved efficient in registering sounds from moving airplanes. In actual practice, it would be used to aid observers in detecting the approach of hostile ships, their direction and distance from batteries.

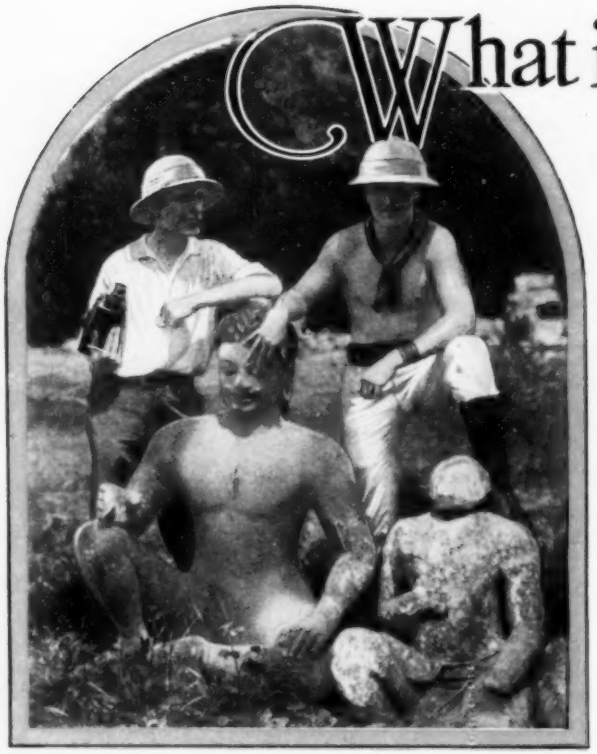
SLOGAN-BEARING STREET CAR AIDS SAFETY CAMPAIGN

Painted white and bearing a number of slogans on the outside, a street car was used effectively during a safety campaign in an Illinois city. As a moving signboard, it attracted wide attention to the necessity of using greater care in crossing intersections and taking other precautions.



Spreading the Gospel of Safety through the City Streets; Trolley Car Painted White and Bearing Cautioning Signs

What is the Most



Statue of a Leper King, Seated, the Only Life-Size Human Figure Found among the Ruins of Pnom-Pher, One of Asia's Mysteries

AT Angkor, in Cambodia, a province of French Indo-China, are the ruins of the Khmers—a vast, lost city which once held more than a million people, who disappeared, where and when no man knows, and left not the slightest trace of their destination behind.

That, says Burton Holmes, the great travel lecturer, is the greatest sight on earth today, and so he puts it at the head of his list of the seven most marvelous things he has seen.

Yet six times as many people crowded in to hear Burton Holmes tell about Switzerland and show pictures of the same scenes they had read about and seen pictured for years as came to hear him tell about the lost city of Angkor.

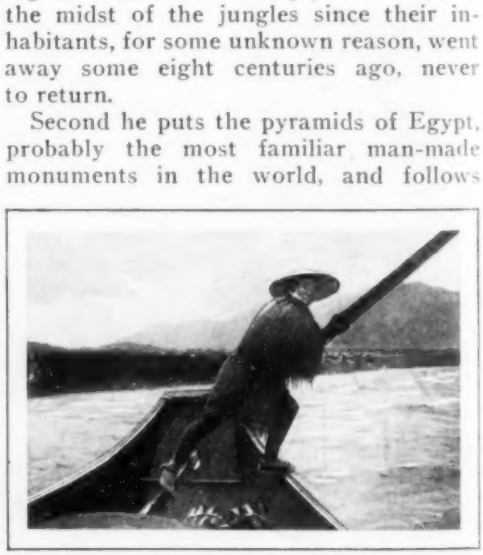
The reason, says Mr. Holmes, is that people prefer to hear and see the things they have always heard and seen, since it is to the places already known that most of us dream of going. Nobody, virtually, knew anything about the ruined city of the Khmers, and when the lecturer came back from a trip into the jungles of Cambodia with reels of movies and a vast store of fascinating information, he discovered that not many people cared to know about it.

Burton Holmes has spent most of every year since 1892—when he was twenty-two years old—traveling around the world as deputy eye for the folks at home, and in his thirty-four years of travels he has covered more than three million miles outside of the United States, in addition to a vast mileage piled up at home during his winter lecture tours. He has seen every civilized country and practically every uncivilized one, and probably knows every nook and corner of the globe better than any living man, or any man that ever did live, since his occupation is, or at least once was, virtually unique.

Out of his thirty-four years' experience he compiled for Popular Mechanics readers a list of the seven greatest sights he has ever seen. One of the seven is in the United States—the Grand Canyon of the Colorado—and he puts it fourth on this catalog of wonders.

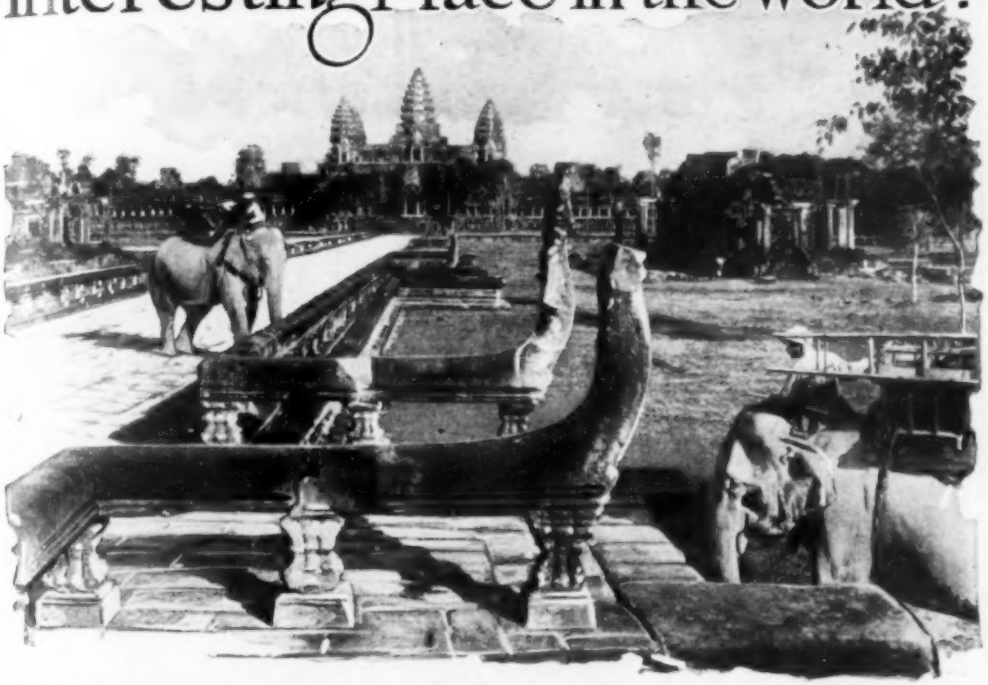
First of all come the ruins of Angkor—a vast city of magnificent stone buildings that have stood empty and alone in the midst of the jungles since their inhabitants, for some unknown reason, went away some eight centuries ago, never to return.

Second he puts the pyramids of Egypt, probably the most familiar man-made monuments in the world, and follows



Chinese Boatman Sculling His Craft through the Rapids Just Below Gorge of the Yangtze-Kiang

Interesting Place in the World?



Ruined Palace and Gardens of the Khmers at Angkor, Cambodia, Who Disappeared, with a Million People, When and Where No Man Knows, Leaving the World's Greatest Sight Behind in the Jungle

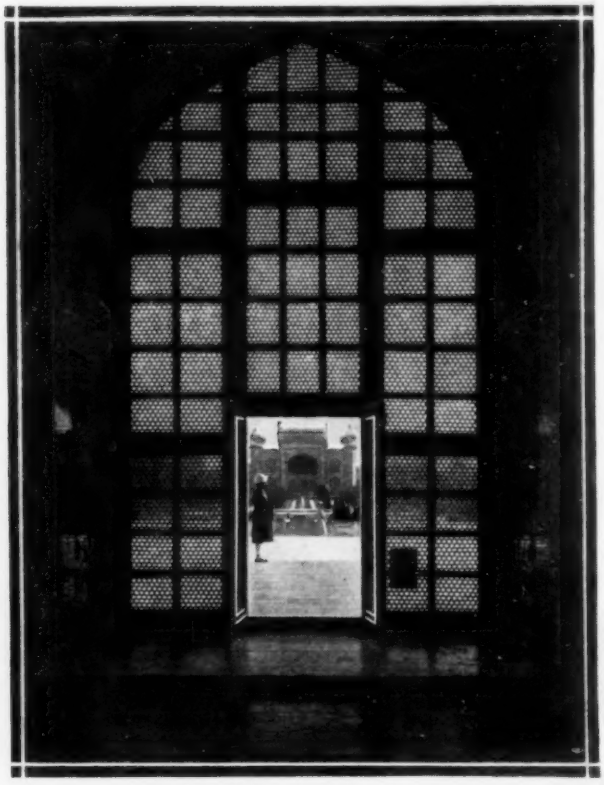
them with the Taj Mahal, acclaimed by artists and architects as the most perfect building ever erected.

Fourth is our own Grand Canyon, and fifth the little known Meteora monasteries, parked atop the granite cliffs overlooking some of the deepest gorges in all Thessaly. Sixth, he selects the shrines of Nikko, Japan, with their incomparable gateways —architecture well-nigh as perfect as the Taj Mahal, which also is a shrine, built by an Indian prince in memory of his queen.

Last come the gorges of the Yangtze-kiang, China's most famous river.

Of his seven greatest sights, one, the great pyramid of Cheops, is the only survivor of the famed seven wonders of the ancient world. The biggest and costliest tomb ever built, taking the work of 100,000 men for twenty years, it remains today a marvel to engineers because of its mathematical perfection. Standing originally 481 feet high, with a base measuring 755 feet on each side, engineers have been able to find an error of only sixty-five hundredths of an inch in the base and one three-hundredths of a degree in the angles of the corners.

The Nikko shrines of Japan, covering a vast forest tract, with one of the world's most beautiful roads leading for twenty miles to the uncomparable temple gates, are a memorial to two great warriors, Iyeyasu and Iyemitsu, once masters of Japan, but now gods. The two are the Caesar and Napoleon of Japan and in the three centuries or more that have passed since the great collection of shrines were laid out the setting has become one of the most beautiful in the world. The Yomeimon, or "Gate of Beauty," a thing of indescribable grandeur, commonly called by the Japanese the "sunrise to sunset" gate, because, they say, it would take fully that long to examine all of its marvelous carvings, is the gem of the shrines. Beneath the spreading eaves of a tiled roof, hundreds of furious beasts, dragons, lions, doglike creatures, "a sculptured nightmare," as Holmes describes it, is heavily overlaid with gold and lacquer, the inch or more of gold at places giving the effect of solid metal. Side by side with the grotesque creatures are beautiful gate panels that seem to actually bloom with gorgeous chrysanthemums and a maze of



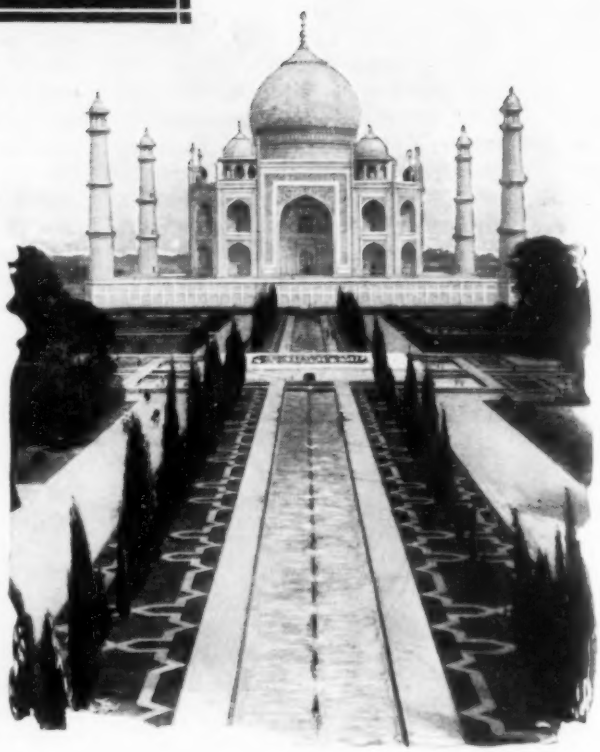
© Publishers' Photo Service

Looking Out through the Marvelous Carved Marble Door Screen of the Taj Mahal, at Agra, India, Above, and the Taj Itself, at the Right, Famed as the World's Most Beautiful Building

delicate tracery. The workmanship is so perfect that no hidden defect has ever been found, but on one pillar the artists deliberately inverted a design and carved it upside down, stopping short of perfection out of deference to Heaven, and to avoid the jealousy of the gods who might be aroused by such a perfect piece of art from the hands of men.

Like the ruins of Angkor and the Japanese shrines, the monasteries of Thessaly are little known in this country. Perched on jutting crags, high above deep and dark valleys, they are one of the last surviving relics of an age when safety lay only in seclusion. To reach many of the group of buildings it is necessary to be tied up in a net and hauled aloft on a rope lowered by the monks above. The principal buildings stand, apparently, on islands in mid-air, while all along the canyon sides, high out of reach, are the deserted caves and bird-nest-like dwellings once peopled by the hermits of the Middle Ages, when hermit hunting was a fashionable sport among the Turks and no one was safe if his home could be reached by anybody else.

Lecturing every winter before thousands of his fellow Americans, Mr. Holmes has accurately indexed their interests and desires. First, he says, they want to know about the countries of Europe, especially those they have visited or hope some day to see. To see, in the travel



© Baker
America's Contribution to the Seven Greatest Sights, the Grand Canyon of the Colorado

movies, a place one has already visited, gives a bigger thrill, he finds, than to see the film of some country one never expects to visit.

His own choice, after trying them all, is Japan in the Orient and Italy in the Occident. Climate, customs and a wealth of beauty spots dictate his selection. He likes Japan, the Japanese and their habits so well that he has adopted Japanese dress—kimono and sandals—for his private life and only turns to European clothes when appearing in public. His studio in New York, where he makes his home for the few days or weeks he can spare each winter from his lecture tours, is filled with works of art from all over the world, but Japanese treasures predominate.

He picked the pleasant occupation of wandering around the world looking at things for other people more or less by accident. "I wanted to lead the carefree life of a millionaire," says Holmes, "but I lacked the wherewithal, and so I became

a traveler and have been at it ever since." Born in Chicago in 1870, he had visited Europe at sixteen, going back again six years later. From that trip he returned with a wealth of pictures and information, and decided to give a lecture about what he had seen. It paid so well that he collected enough to go back again.

"It is ever fascinating to me," he says. "Japan always gives me pleasure, because, while it is now civilized and clean, yet it is totally different from anywhere else in the world. When I go to a foreign land I practice the Pierre Loti fashion of expatriating myself, living the lives of the natives better to understand the country. Above all places I think I should choose Italy and Japan in which to live, dividing my time between them. They are so good to look at and always refreshing and beautiful. Here in America we spend millions of dollars for carefully designed facades, and even then do not overcome ugliness in the skyline. There are more natural pictures for the eye in Italy than perhaps anywhere else in the world."

In his more than a third of a century of wandering he has been in more out-of-the-way places than a school geography describes, yet he claims never to have had any particularly thrilling adventures, and to prove his claim points out that, while he has lived on railroad trains for several months of the year, he has never been in a wreck, and that twice when ships on which he was to have sailed were lost at sea, something had come up to prevent his being aboard.

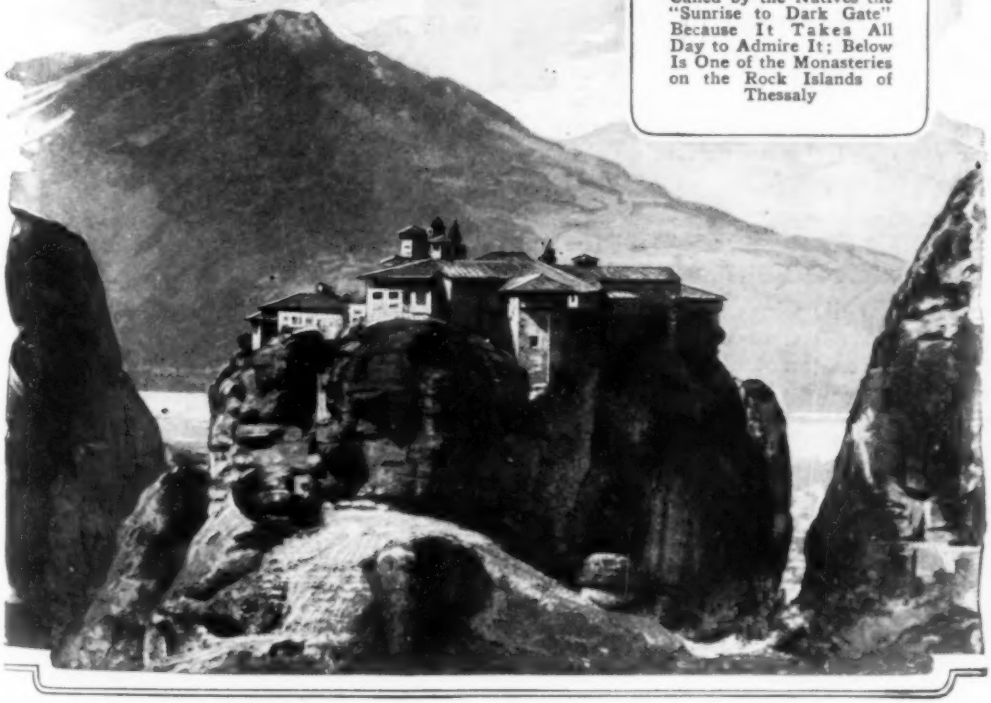
Yet in 1901 he crossed Siberia in forty-two days, before the railroad had been built. It took twenty-seven days to make 1,300 miles on river steamers, and thirty-six times when the boat stuck on sand bars, the passengers had to get out and help push it off, while, in between, they slept on crowded decks and lived mainly on quantities of tea.

As a war correspondent he was caught in the Italian front lines by an Austrian barrage, and escaped uninjured, only to find, when he returned to his car, that it had been blown to pieces by a shell landing far behind the lines. A few months ago, touring the battle fronts in Morocco, he heard bullets whiz by, but the guide explained there was no particular danger since it was only natives taking pot shots at the party because they were Christians.

Only One of the Seven Wonders of the Ancients Still Survives, the Great Pyramid of Cheops, in the Center, Which Holmes Places Second on His List of Wondrous Sights

© Newman

Above Is the Yomiemon, or Gate of Beauty, of the Japanese Shrines of Nikko, a Marvelous Piece of Gold-Lacquer Work, Called by the Natives the "Sunrise to Dark Gate" Because It Takes All Day to Admire It; Below Is One of the Monasteries on the Rock Islands of Thessaly



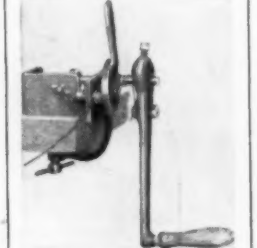
Within Easy Reach of Passers-By; Wire Basket for Rubbish on Street-Light Pole in Munich

RUBBISH RACKS ON LAMP POLES HELP KEEP CITY CLEAN

Receptacles for rubbish are conveniently placed within easy reach on the poles along the streets of Munich. They are easily kept clean, save the trouble of raising the cover on the old type of cans at the curb and the content is quickly removed for disposal.

WINDER FOR COILING SPRINGS MAKES DIFFERENT SIZES

Needing coil springs of various sizes for replacing broken ones in operations on the oil fields, an Ohio man devised a winder with which he could make his own.



It consists chiefly of a hand-power reel in which mandrels of different sizes can be used and the pitch or lead of the spring determined by the position of a little cam set in various positions. Springs of a wide variety of length, and either right or left-hand, can be quickly coiled on this winder with as good results as on a lathe, it is claimed. The device is being put on the market by an eastern manufacturer.

EGGS CLEANED BY SAND BLAST TO PREVENT DAMAGE

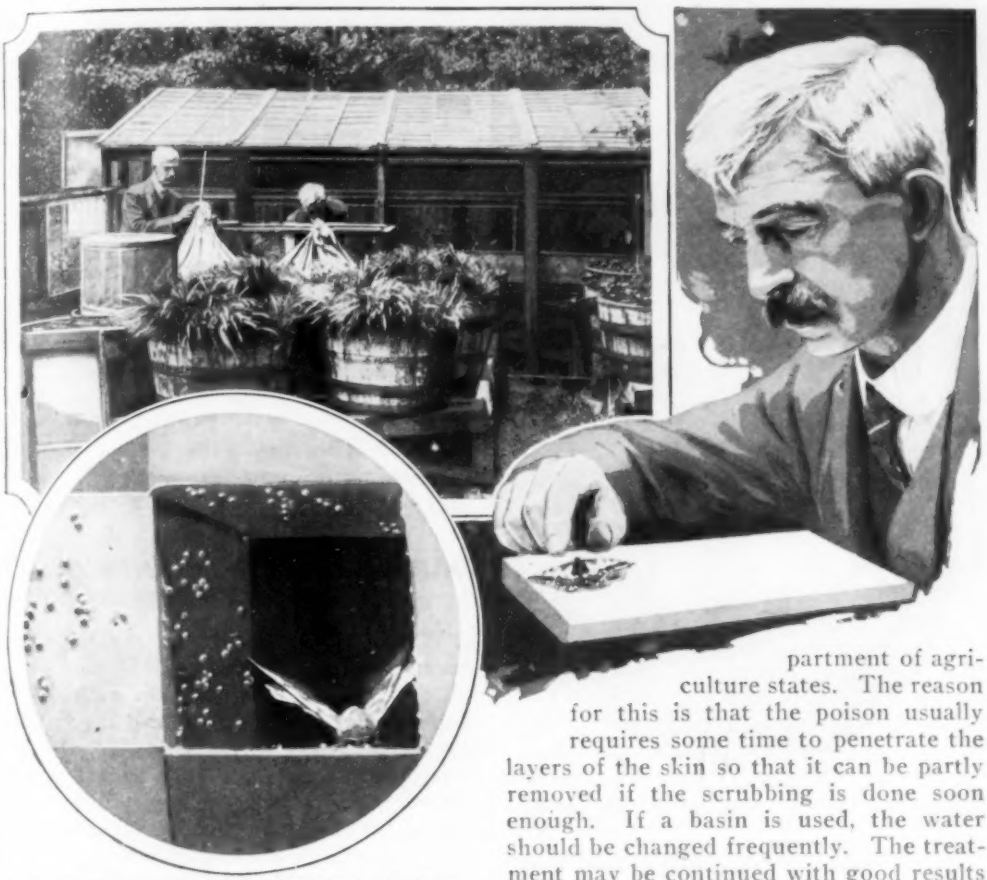
To eliminate the drudgery involved in cleaning eggs and the harmful effects in washing the shells with various compounds, a combination sand-blasting and grading apparatus has been put into use by western producers. It has a capacity of 300 cases or 9,000 dozen a day. A fine grade of white sand is used for the cleansing and is driven against the eggs, three dozen at a time, by a current of air. After the scouring, the sand is blown out by a small fan. From the cleaning compartment, the eggs pass over a battery of powerful electric lights, and an attendant candles them as they move along to the packers, who put them in crates ready for marketing. Because of their excellent condition after this treatment, the product is said to bring from one to four cents more per dozen than eggs that have been cleaned in the ordinary way.

AUTO JACK IN WHEEL SOCKET ALSO SERVES AS LOCK

Eliminating the use of a crank, lever or other means of lifting, an auto jack is slipped into a permanent socket on the back of the wheel. The car is then moved slowly until the base of the jack is fully on the ground. This raises the car sufficiently to give the tire on that corner a clearance of six inches. The jack may be used also as a mud hook and as a lock, a hole being provided for adjusting a padlock.

¶ Earthquakes that occur under the ocean are said to have much greater severity than those experienced on land.

BUTTERFLIES FED ON BOTTLE AT UNIQUE FARM



L. W. Newman and Scenes at His Butterfly Farm; Thousands of Specimens Are Raised for Collectors

Bottle-fed butterflies may be seen in great numbers on the farm of an English naturalist who raises the insects for zoos, museums and schools. His charges number as high as 50,000 at one time, some of them being nourished by sugar and water which they sip from cotton stuffed into the neck of a bottle. During the egg-laying period, the moths and butterflies are confined in specially constructed cardboard boxes for better protection.

HARM OF TOUCHING POISON IVY REDUCED BY WASHING

Several thorough washings with hot running water and ordinary alkaline kitchen soap, as soon as possible after contact with poison ivy, will greatly reduce the harmful effects from the plant, the department of agriculture states. The reason for this is that the poison usually requires some time to penetrate the layers of the skin so that it can be partly removed if the scrubbing is done soon enough. If a basin is used, the water should be changed frequently. The treatment may be continued with good results even after inflammation has developed. Applications of solution of cooking soda, Epsom salts or fluid extract of grindelia, diluted with four to eight parts of water, are beneficial, but if the poisoning is severe, a physician should be consulted. Washing is also recommended after contact with sumach or poison oak.

CHECK PROTECTOR LIKE PLIERS WORKED BY HAND

Checks are quickly and permanently safeguarded against forgery and raising by a hand protector operated like a pair of pliers. A dial on one side is turned to make an impression from number stamps, according to the amount of the check.

Wearing Golf Cap with "Magazine" of Tees, and Close View of Band, Showing How They Are Inserted

GOLF TEES ARE CARRIED IN HAT TO PREVENT LOSS

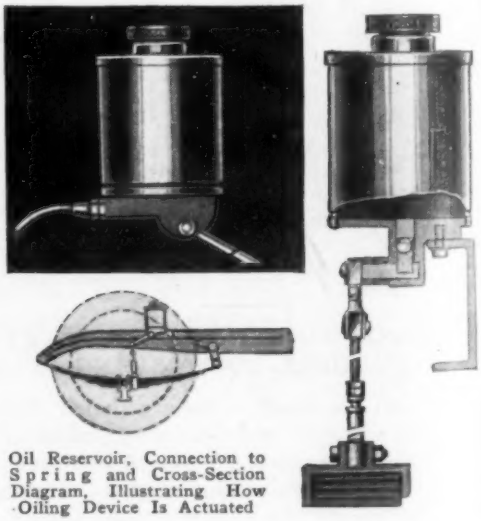
Space for several golf tees is provided in the outside band of a cap with a wide visor to shade the player's eyes. The tees are held securely and are always accessible, sparing the golfer the inconvenience of searching through his pockets or club bag.

TWENTY-EIGHT FLYERS SAVED BY ARMY PARACHUTES

Fibers spun by the caterpillar are flimsy and brittle, but woven into silk cloth for army parachutes, they have been instrumental in saving at least twenty-eight persons from death in airplane accidents. All these are enrolled in what is known as the "Caterpillar club." The dependability of the army parachute has been demonstrated repeatedly. Aug. 24, 1920, flyer O'Connor, a civilian, staged a leap at McCook field expecting to try a "pet brand" of parachute. It failed to open, but his life was saved in the folds of an army chute which he had been persuaded to take along. The longest leap on the club's records was made from an altitude of 10,000 feet by Lieut. J. T. Johnson of Selfridge field, near Eaglesmere, Pa. Lieut. John A. Macready, noted altitude flyer, made a successful jump by night over Dayton. He guided his crippled plane away from the city where it would not be likely to do damage on falling, and jumped. Later, walking into a circle of excited persons who had gathered about his blazing plane, he gave them a startled moment, for they believed that he had been crushed under the ship. Aug. 29, 1924, Lieut. L. L. Kontz and Private W. E. Goggin of Bolling field both jumped from the same plane and landed safely.

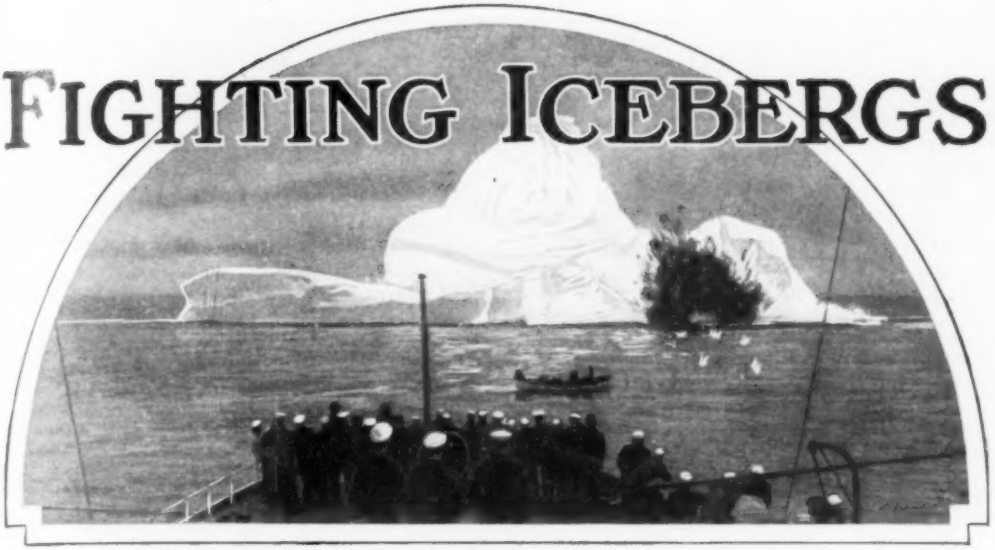
AUTO SPRINGS OPERATE OILER TO LUBRICATE CHASSIS

When the auto bounces, the chassis is given an oiling. This is the feature of an automatic lubricator which utilizes the action of the springs to keep the chassis greased. An oil reservoir and plunger pump are so adjusted that, when driving over uneven roads, the deflection of the springs will actuate the pump, forcing a small amount of lubricant into the parts when it is most needed. Ordinarily, the reservoir needs filling about twice yearly.



Oil Reservoir, Connection to Spring and Cross-Section Diagram, Illustrating How Oiling Device Is Actuated

FIGHTING ICEBERGS



Shattered Ice, Powder-Blackened, Is Hurled High in the Air as U. S. Coast Guardsmen Explode a T.N.T. Bomb in an Effort to Destroy an Iceberg Floating in the Steamer Lane

American Coast Guardsmen on the International Ice Patrol Ride Herd on Drifting Mountains and Try to Destroy Them

By F. A. ZEUSLER
Lieutenant Commander, U. S. Coast Guard

IT is midnight in the open North Atlantic off the Grand Banks of Newfoundland, and the U. S. coast guard cutter "Modoc" is rolling in the heavy swell. On the high bridge seamen stand at the searchlights, playing their beams over a mountain of ice. All around us is the hurrying traffic of the busiest ocean boulevard in the world—the North Atlantic steamship lane. Warned by the lights focused on the million and a half tons of iceberg, the ships veer to the south and dash past at twenty knots.

Fourteen years ago, in these same waters, the giant "Titanic," making her maiden trip, plowed into an underwater off-shoot of one of these giant bergs and went down with more than 1,500 souls. The next year the International Ice Patrol, paid for by all the big maritime powers, but performed by two American coast guard cutters, came into being, and since that time not a ship has been lost.

In the radio room of the "Modoc," or her sister cutter, the "Tampa," when they exchange places, as they do each fifteen days, operators stand by every hour from March 1 to the middle of July, copying and transmitting a steady stream of messages. Last year the ships of fourteen nations—more than 500 of them in all—were guided through the danger zone by the radio reports from the ice patrol.

Greenland's icy mountains, made famous by a song, furnish all the bergs that menace the Atlantic shipping lanes. Each spring they break loose from the glaciers and start on their 1,800-mile journey south to eventual disintegration in the warm Gulf stream. On March 1, the ice-patrol ships put to sea, one from Boston, bound direct for the danger zone, and the other from Wilmington, N. C., en route to Halifax, N. S., the base of operations, where they refuel, take on provisions and give the crews shore leave between patrols.

One man of the two crews, the oceanographer, remains on duty on the Banks throughout the season, transferring to the relieving boat each time. His duty is to keep track of every berg, plot its position and course, and furnish the radio bulletins of information and warning to shipping. As the first cutter puts to sea, a

radio message is broadcast to all ships and land stations that the ice patrol is on the job, followed by a request that all shipping approaching the Banks send position, course and temperature of the sea at four-hour intervals. The last is the important thing. The bergs, sweeping south in the Labrador current, meet the Gulf stream near the Grand Banks, and rapidly disappear in its warm water. The Labrador current, however, is not a year-around stream, but a river of cold water that starts flowing south in the spring, continues for a few months, and then, after losing an unequal battle with the Gulf stream, disappears until the next year.

Early in the spring the two meet down below the southern end of the banks, the cold stream gradually increasing in power until it is whirling the icebergs southward as fast as two miles an hour. Then it begins to fall off, as the warm Gulf stream swings farther northward, and finally, about July 1, disappears for the season.

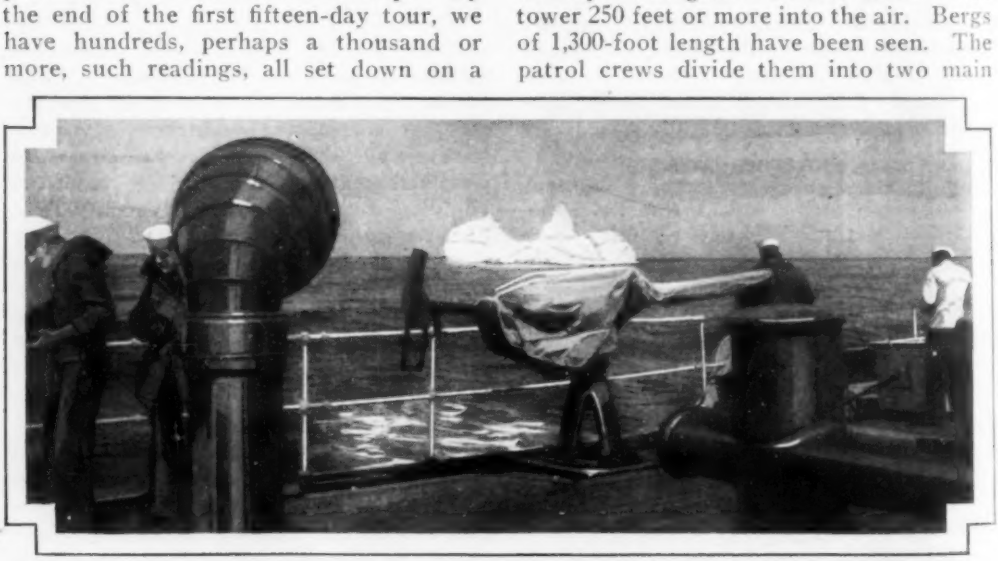
The line of their meeting is not an imaginary one, but a well-marked spot, with olive-green water north of it and the indigo blue of the Gulf stream on the south side. The cold wall is also the usual border line of the fogs that cling for fully half the time over the banks.

The four-hour temperature readings pour in from a multitude of ships. By the end of the first fifteen-day tour, we have hundreds, perhaps a thousand or more, such readings, all set down on a chart, and thereby the outline of the danger zone. We can tell then whether it will be a bad ice year, as 1926 was, with bergs far south of their usual range, or whether it will be a mild one.

All the time the patrol is locating bergs, sweeping north far up toward Greenland to inspect the south-bound squadrons, and then back down to the danger line to ride herd on them as they arrive. Each morning and evening at the same hour the report of every berg in the steamer lane is broadcast. The broadcast message gives the position of each berg, its size, drift and speed. During the day, as each new berg is sighted, a special broadcast announces the fact, and every hour calls from many ships are answered giving special information.

Each berg as it is sighted is photographed, sketched and studied, its course and speed calculated, and finally it receives a number by which it will thenceforth be known until the Gulf stream melts the last of it. Each one has distinguishing marks and peculiarities that are soon recognized for future identification.

Contrary to an accepted belief, icebergs do not turn turtle often, nor usually until near the end of their days. When the patrol first meets them in March, they often are more than 500 feet long, longer than a city block, and the visible portion—which is only one-eighth of their mass—will tower 250 feet or more into the air. Bergs of 1,300-foot length have been seen. The patrol crews divide them into two main



Only One-Eighth of a Floating Berg Is Above the Water, Though the Visible Portion Often Is 200 Feet or More in Height and Longer Than an Average City Block

Cruising Close Alongside, the U.S.S. "Modoc" Rides Herd on a Wandering Berg as It Drifts Southward into the Transatlantic Steamer Lane near the Spot Where the "Titanic" Was Sunk

classes, solid bergs and "drydocks." The latter is simply a berg with a deep saddle depression through its middle, leaving two peaks standing at either end, and bearing a marked likeness to a floating drydock.

So far no great success has been awarded attempts of removing the menace. Last year, the coast guard began experimenting with bombs and mines. In previous years shell fire had failed utterly. A six-pound projectile, fired point blank at 150-yard range, will not penetrate more than half its length. The mines were not much more successful, though, toward the end of a berg's days, they will hasten disintegration by opening up new cracks.

Each year since the patrol was established, in 1913, the anniversary of the "Titanic's" loss, on April 14, has been observed by the crew. At 3:00 p.m., in response to a radio appeal, all ships in the North Atlantic shut down their radio sets for five minutes while the coast guardsmen gather on the after deck of the cutter. The church pennant is hoisted above the American flag at the stern, the ship's surgeon, doubling as chaplain, delivers a suitable memorial address, and three rifle volleys are fired across the waters where the great liner went down.

The ice patrol is carried on in the midst of one of the greatest fishing zones in the world. All around on the Grand Banks, the North American fishermen are working away through almost constant fog, while farther to the east and north is a vast fleet of barks, barkentines and great square-riggers which come out each year from France. To the fishing boats the presence of the patrol cutters prove a godsend. The coast guardsmen trade tobacco and vegetables to the fishermen for fresh fish; the surgeon visits them to set broken arms and legs and treat various diseases, and the cutter's mechanics are always ready to make repairs on a broken fog gun or other gear.

Coming out freshly provisioned each two weeks, the patrol ships find the icebergs have their uses, for a boat can always be lowered to chop off a supply of ice for the ship's refrigerators. The bergs, breaking away from the snow and ice cap of Greenland, which in places is as much as a mile thick, are composed largely of snow, compressed into ice, which accounts for their generally white color, shot through with greens and blues. When a boat draws alongside, where small particles are dropping into the water, the newcomer is surprised to hear the ice effervesce as it strikes the sea, like so much soda water. The reason probably lies in the presence of air in the compressed snow.

Always on Duty and Visible to All Motorists, This Dummy Policeman Guards School Crossing

BOYS' DUMMY OF POLICEMAN GUARDS STREET CROSSING

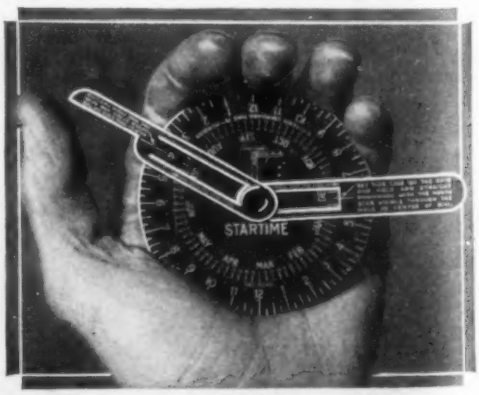
Boys in the woodworking class of a California high school have constructed a dummy traffic policeman to maintain constant guard at an intersection near the building. It is firmly attached to the pavement in the middle of the street and bears aloft a warning sign that is visible at some distance to motorists approaching in either direction.

PROOF OF WEIRD FISH TALES FOUND IN COLLECTION

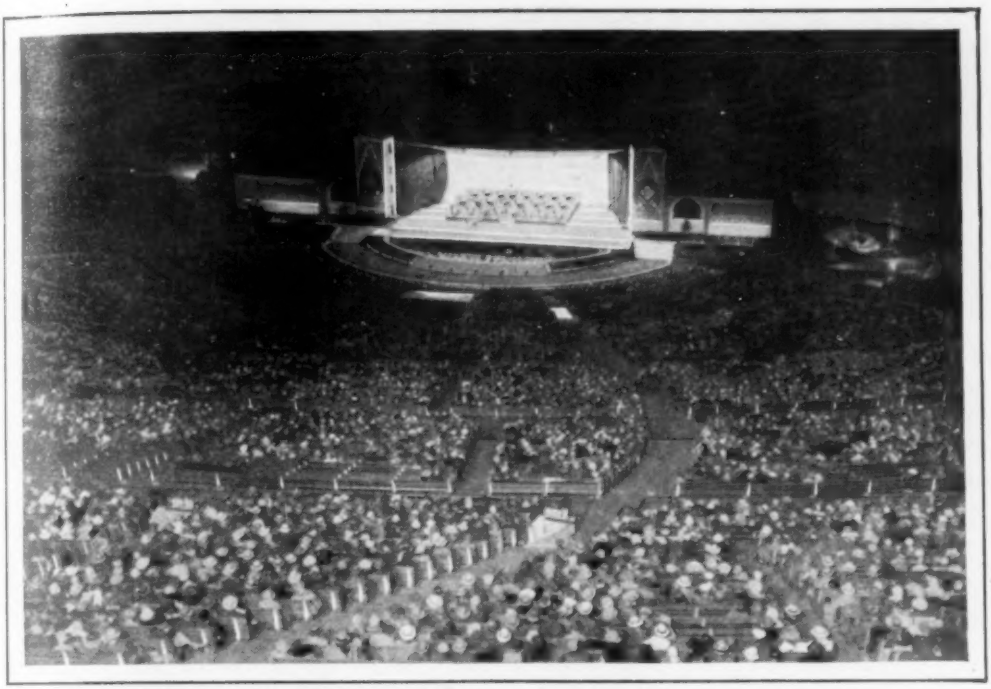
Specimens that furnish a basis for some of the wild stories told about inhabitants of the deep seas have been gathered during a 20,000-mile cruise of the schooner "Blossom." One of the most interesting species captured was a Portuguese man of war, a fish having tentacles speckled with microscopic bombs which explode when they strike a victim and minute harpoons that inject an acid poison into the flesh. Another, known as the "sea devil," closely resembling the stingaree, is said to be able to pull the weight of a vessel after running afoul of the anchor chain, and a blow from its wings will stave in a small boat. The golden dolphin was also captured. These fish are reputed to be the swiftest inhabitants of the ocean.

TELLING TIME BY STARS EASY WITH AID OF POCKET DIAL

For thousands of years, man has checked the passage of time by the position of the stars, but for the most part, this task has been left to the astronomers and their great telescopes. Now, with the aid of a little pocket dial, almost anyone who can read can learn the hour of night by consulting the stars. The instrument consists of an aluminum disk with a hole in the middle and two movable arms which rotate about the center. The circumference of the disk is marked out into the quarter hours of a twenty-four-hour day and an inner circle is graduated into the months and days of the year. The observer first sets the date arm and, with it pointing downward, sights the north star through the hole in the disk. Then he moves the time arm around until it is lined up with the two edge stars in the bowl of the Great Dipper. At that position, the arm will indicate the correct time. The instrument, which simply translates the movements of the "heavenly clock," the circuit of the Great Dipper about the Pole Star, into hours, may also be used for estimating latitude and longitude. With its carrying case and instruction book, it weighs less than an ounce, fits flat in the pocket and is serviceable to campers.



Dial for Telling Time by Stars, Showing Date and Time Arm and the Graduated Center



Remarkable Night Photograph of Hollywood Bowl Where Twenty-Four Pianos Were Played in Ensemble to Test Acoustics of This Natural Outdoor Theater; It Has Seats for 30,000 Persons

PLAYING TWENTY-FOUR PIANOS TESTS OUTDOOR THEATER

Music from twenty-four pianos, played in ensemble, was one of the features of the dedicatory program in the newly constructed Hollywood bowl, near Los Angeles. This outdoor theater has remarkable acoustics, tests having shown that sounds can be more clearly heard in it than in many interiors. There are seats for about 30,000 persons, and the bowl is one of the first units in a proposed $1,000,000 public center in the Hollywood hills.

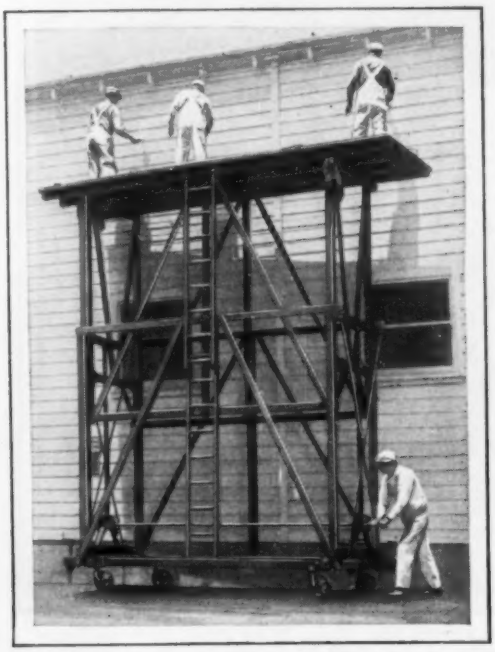
MYSTERY IN FLOATING ISLAND THAT RISES AND SINKS

Rising to the surface about the middle of August each year and sinking in February, a floating island on a small lake in Michigan has been a riddle to investigators. Efforts have been made to keep it submerged under tons of rocks but it bobs up again in spite of the burden. Another floating island on Henry's lake in the Rocky mountains is said to sail at the rate of five miles a day, and unsuspecting travelers who land on it quickly become confused and often lost. Some of these wandering isles are accumulations of brush and driftwood and their alternating rise and fall has been attributed to the growth and decay of perennial plant roots.

SHOE POLISHER FOR HOTELS TO SAVE FURNITURE

Consisting of two rollers, a block and a shining cloth, a shoe-polishing stand intended for hotel rooms is expected to prevent needless marring of chairs and other articles of furniture. The cloth is adjusted in such a way that all parts of the shoe can be reached and, when not in use, the lid of the stand is lowered so that it may be used for other purposes. A similar polisher is being made for home use.

WHEELED STAND FOR PAINTERS ADJUSTED WITH CRANK



Portable Staging on Painting Job; Workman at Right Is Elevating the Platform with Crank

As a substitute for ladders or suspended scaffolds, an elevating platform on wheels enables painters or other workmen to keep a convenient operating position with little time required for shifting from place to place. The platform is raised or lowered by means of a hand crank and is geared for easy manipulation. Little danger attends the use of this equipment and it saves scratching the sides of walls.

SAW WITH REMOVABLE TEETH CUTS ACCURATE GROOVES

For grooving, molding and other special operations, a saw with removable teeth of high-speed tool steel, is said to insure accurate work and to save time in sharpening. Wear on the teeth is compensated for by moving them outward, as needed, a rack fitting a special lock providing exact adjustment with little trouble. New cutters or those of a different pattern may be inserted without taking the saw from the mandrel.

BURBANK'S WORK IS CONTINUED THROUGH UNIVERSITY

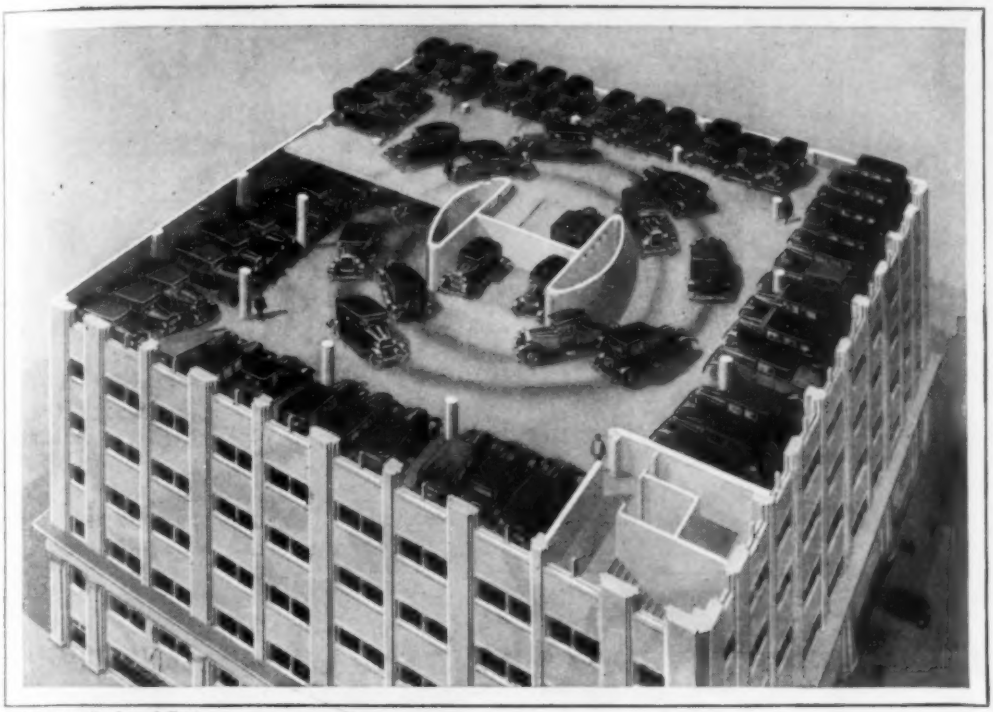
Although Luther Burbank is dead, his experiments are being carried on under a foundation controlled by Leland Stanford university. The plant wizard made the arrangements not long before his death, as he preferred to have his work continued rather than accept large sums which were offered him for his thirteen-acre farm. Thousands of the plantings are yet in the developing stage and will require years of research before final results are known. In all, there are 53,874 plants, trees, shrubs, bushes and vegetables in the picturesque and extensive gardens.

PEN POINTS QUICKLY CLEANED WHILE STILL IN HOLDER

Without removing them from the holder, pen points are thoroughly cleaned with a pincer-shaped, padded accessory a German inventor has devised for the writing set. The soft lining prevents injury to the point, absorbs clotted ink and also keeps stains from the fingers. The cleaner is finished in different styles to harmonize with the other writing equipment in a special set.

GOLD BURIED DURING CIVIL WAR SCRATCHED UP BY HEN

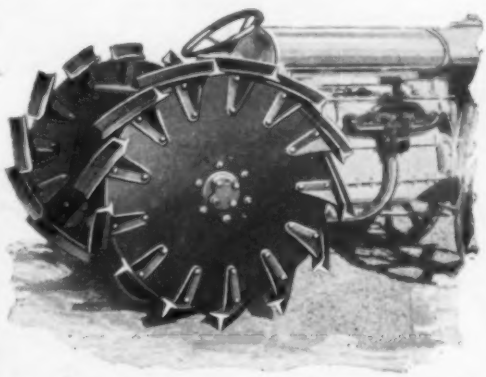
Scratching in a Kentucky garden, a hen uncovered a mystery of sixty-two years' standing. She dislodged a goldpiece that was part of a $1,600 treasure pot buried by a man as he entered the Civil war in 1864. He died a prisoner without revealing to members of his family where the gold was hidden. It was all recovered after the first piece was found.



Courtesy Condron & Post
Model of the Spiral-Floor Garage; Cars Are Seen Winding About as Though Entering and Leaving, and Storage Spaces Are Indicated; Roomy Center Area Easily Affords Two-Way Traffic

SPIRAL FLOOR IN HIGH GARAGE REPLACES RAMPS AND LIFTS

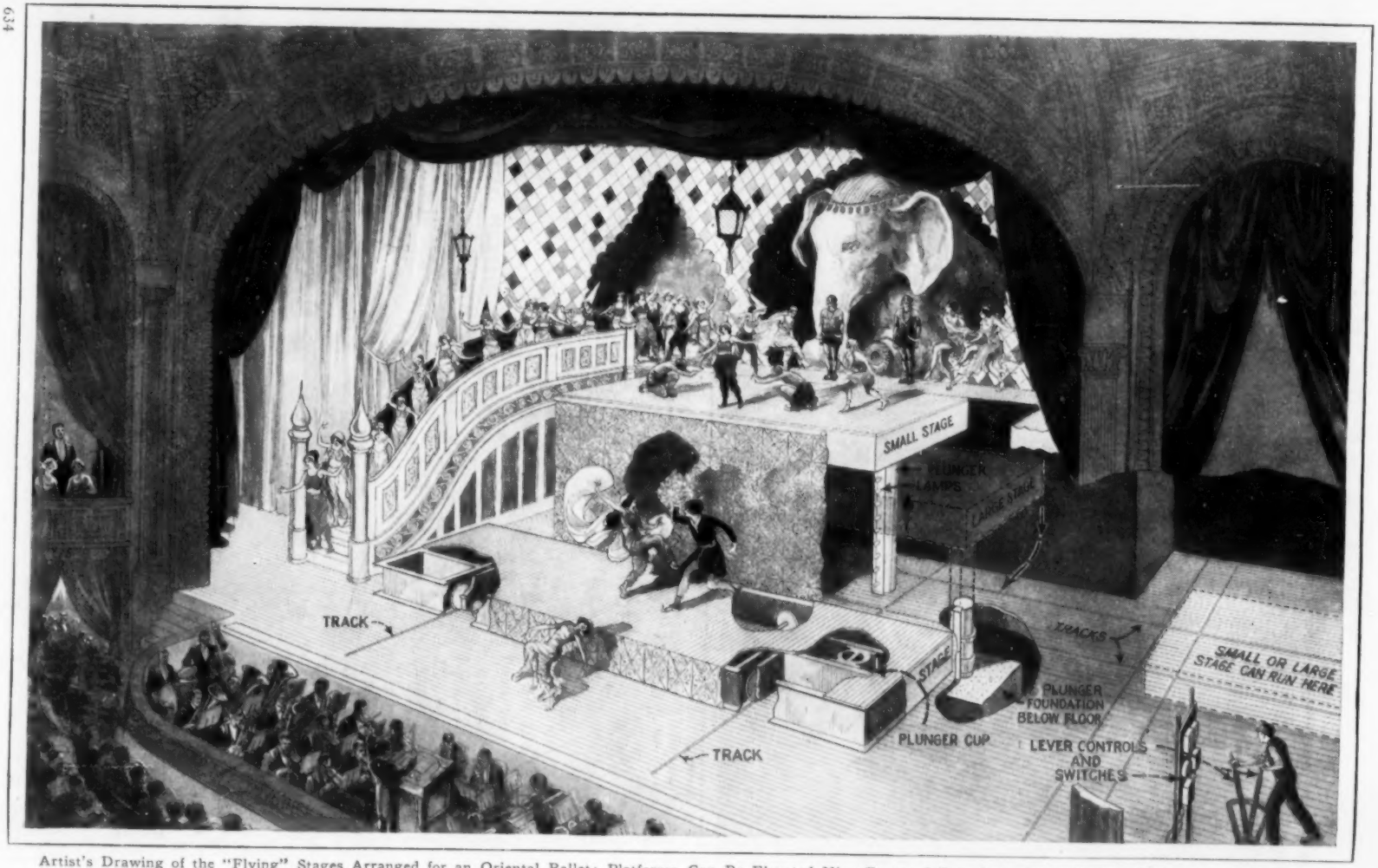
Automobiles ascend under their own power, without the need of elevators or ramps, in a patented skyscraper garage devised as a solution of the parking problem. It is estimated that a building of this type, holding 500 cars, could be emptied or filled in thirty-three minutes. The floors are arranged in spiral fashion, furnishing a continuous driveway at gentle slope from the top to the bottom. Drivers can handle their own cars without the assistance of attendants and, when they reach their floor, they may walk down steps or ride in passenger elevators. The spiral plan may be adapted entirely to shop purposes, allowing a promenade in the center of the structure with abundant show-window space on the inside. In the garage plan, the central spiral is wide enough for two lanes of travel, one ascending and the other descending.



Tractor Wheel with Separate Treads Instead of Usual Corrugated Rim; Space Is Left for Dirt to Fall

TRACTOR WHEEL WITHOUT RIM REDUCES POWER LOSS

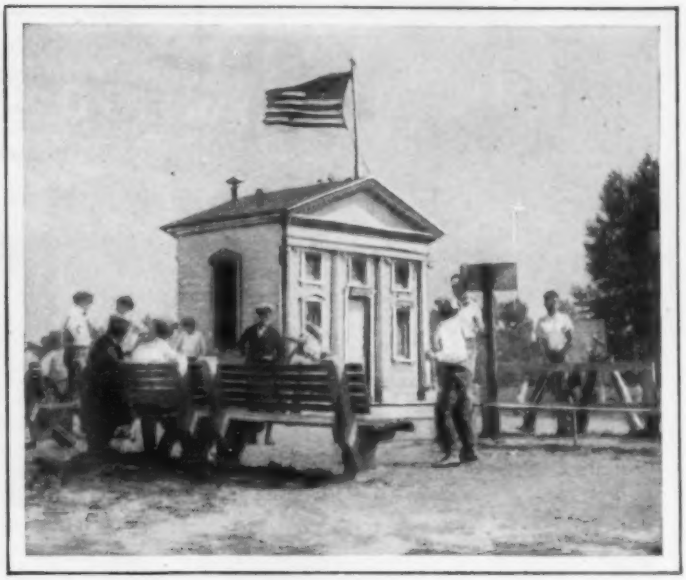
Self-cleaning and of simple, rigid design, a rimless tractor wheel devised by a western inventor is said to eliminate one of the chief causes of loss of power in such units, that is, the tendency of the soil to become packed on the wheel, thus decreasing traction. A firm grip on the roadway is obtained by means of separate treads spaced sufficiently far apart to permit loose soil or mud to slip through.



Artist's Drawing of the "Flying" Stages Arranged for an Oriental Ballet; Platforms Can Be Elevated Nine Feet and Run Outward to the Footlights, Back Stage or to Either Side; They Are Controlled by Levers at Right; a Curtain Drop Unwinds and Conceals Lifts as Platform Rises

WHEELED STAGES GIVE NOVEL EFFECTS

Saving time in shifting scenes and affording opportunity for settings that would be impossible or constructed only at great expense on an ordinary platform, lift stages on wheels have been added to the theater's equipment. They are propelled by electric motors and lifted by hydraulic pressure. They may be rolled sideways, backward or forward on small steel tracks set in the stage proper and, if desired, can be pushed entirely out of the way when not in use. Two of these stage cars were installed recently in a new Chicago theater. The larger, nine feet wide and thirty-two feet long, weighs about 5,000 pounds. While an act is in progress on it, a second may be staged on a smaller car, which rolls under the larger or may be used alone. Lifts raise the cars to a height of nine feet above the main stage. To shift gears, so that the car may move from a forward to a sideways direction, or vice versa, a lever is turned at the back of the car.



Where Golfers on a St. Louis Course Start Their Games; Ticket Booth in Form of Little Temple

TINY TEMPLE ON GOLF COURSE USED AS TICKET BOOTH

One of the smallest municipal structures in St. Louis, Mo., is a ticket booth built to resemble a miniature temple on one of the city golf courses. It adds greatly to the appearance of the links.

NEW STYLE OF STEEL HELMET GIVES MORE PROTECTION

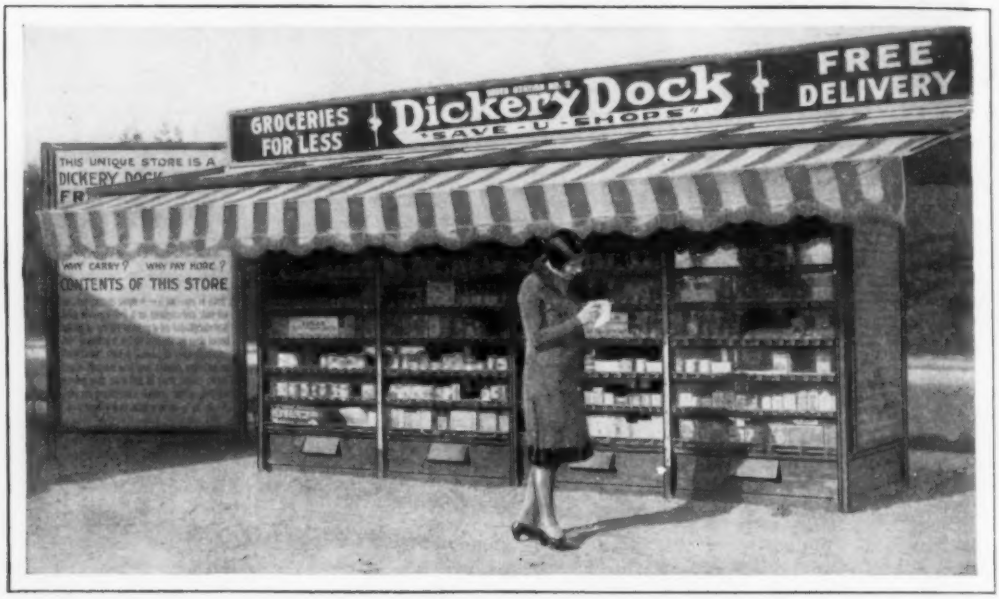
More of the face is shielded by a new style of steel helmet submitted to the ordnance department, and its higher crown is also regarded as a factor in its favor. It has a steeper slope than the old style so that, it is expected, missiles will be likely to glance off and do less damage.

© Henry Miller

Brig. Gen. C. C. Williams, Chief of Ordnance, Examining New and Old Styles in Tin Hats

SPEEDER TRAPPED BY WHISTLE ON AUTO EXHAUST

By means of an automatic whistle a Frenchman has devised, speeding autoists are made to advertise the fact that they are exceeding the legal limits and thus work their own undoing. The attachment fits on a by-pass leading out of the exhaust pipe. As long as the car proceeds at a normal rate, it makes no sound, but at high speed, the increased force of gases produces a screaming noise that can be heard at a great distance, it is said.



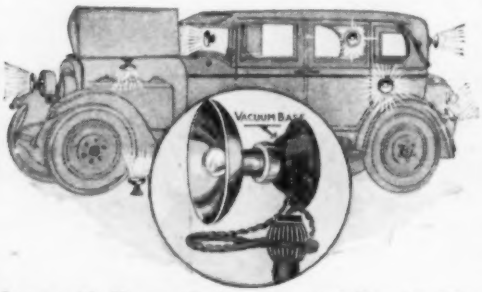
Patronizing the Clerkless Grocery; It Is a Big Display Counter at Handy Street Intersection; Customers Prepare Their Orders on Card Which Is Later Collected and Goods Delivered

PUSH-BUTTON CORNER GROCERY SAVES PHONING FOR ORDERS

Customers can see the goods before ordering and are spared the trouble of telephoning by means of a street-corner grocery-display shop in a California city. It is essentially a permanent showcase with a set of push buttons for registering on a card what articles are wanted. The slip is signed with the person's name and address, dropped in a slot and collected later for delivering the order.

VACUUM-BASE TROUBLE LIGHT HOLDS TO ANY PART OF CAR

Plugged into the dash-bulb socket or headlamp, an auto trouble light has a suction-cup base of live rubber so that it can be attached to practically any surface of the car. It is said not to injure polished metal or enamel, holds firmly and the flat bottom permits setting the light upright on the ground or beside the auto.



Lamp with Vacuum-Socket Base, and Drawing That Shows Installation at Several Points in Car

POISON GUN TO KILL WEEDS ELIMINATES PULLING

Rooting dandelions or other weeds from the lawn is an unpleasant task and often injures the sod. These disadvantages are said to be overcome by a poison gun with which a quantity of liquid is injected into the heart of the weed, resulting in its withering and death in a few hours. The implement is a tubular-shaped barrel holding gasoline or chemicals, and has a sharp point which is thrust into the weed. Pulling a trigger injects the liquid.

To Kill Weeds; the Poison "Needle" Injects Chemicals into Roots of Troublesome Plants

¶Rats can adapt themselves to almost any climate from that of the arctic regions to the tropics.

SMITH MOST COMMON NAME, JOHNSON CLOSE SECOND

According to estimates of a statistician, there are 1,304,300 Smiths in the United States and 1,024,200 Johnsons. Brown, Williams, Jones, Miller, Davis, Anderson, Wilson and Moore follow in the order named. This relation varies in different cities. In New York, for instance, Cohen is second to Smith and Schwartz fifth. In Chicago, the Johnsons are more numerous than the Smiths. Meyer occupies third place in Cincinnati, and in Boston the Sullivans claim second. The estimates were prepared from army and navy enrollment files and are based on a population of 112,000,000. Why there are so many Smiths is a puzzle. In early times, one name was enough. Apparently, when surnames were chosen, more persons took that of the craftsman than any other, but the reason is not plain. Another riddle is why John's son so far outstripped James' son or Philip's son.

SAFETY SIGNS FOR CHILDREN WARN AGAINST AUTOS

To reduce automobile accidents at street crossings near schools, Herman Richter, Jr., a twelve-year-old Springfield, Mass., boy has devised clever warning signs for the pavement. They show a comic figure with hands raised over the word "Stop," and another with head turned in the direction of approaching traffic over the caution, "Look." Both figures and letters are legibly painted in characters large enough to attract the eye from a considerable distance. Young Richter was presented with a prize for his creation which has been highly commended by safety experts.

Pictures and Lettering on Pavement Warn Children and Other Pedestrians of Hazards of Crossing

"Walking" to Pump Up a Tire; Foot Action Forces Air through Hose without Stooping Over

FOOT PUMP FOR AUTO TIRES ELIMINATES BACK STRAIN

Operated by foot power, a pump for inflating automobile tires saves the arm and back strain usually accompanying the working of the ordinary hand pump. The weight of the body compresses the two plungers of the new pump, the user simply "walking standing still" to force the air.

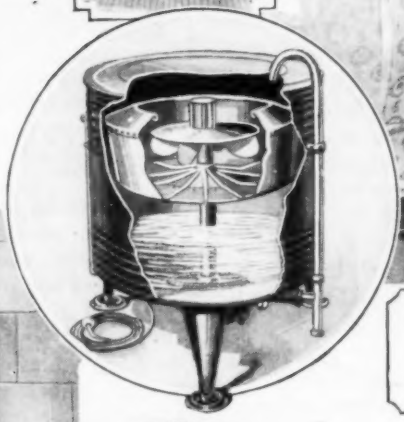
DOG POPULATION OF AMERICA TOTALS SEVEN MILLION

Estimates of the department of agriculture show that there are approximately 7,000,000 dogs in this country. About sixty breeds are recognized and forty-six of this number are considered of sufficient importance to be included in an official classification which has been issued by the department. A short discussion of each breed gives the reader concise information concerning its history, general characteristics, utility and distribution.

New Ways to Avoid Home

Strongly Propped Ironing Board Fitted into Door Panel Is Always Ready for Use, Saves Space, as It Folds Flat When Not Needed, and Eliminates Lifting and Storing

To Protect Watch from Pickpockets; If It Is Jerked Suddenly, Little Prongs Spring Out of Acorn Attachment and Hold It to Cloth



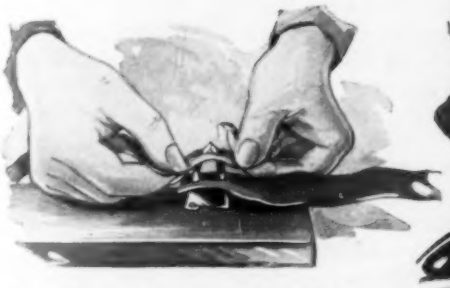
Whirling Electric Washer Empties Itself Automatically by Means of Small Pump, Thus Saving Much Heavy Lifting

Hot Water in Small Quantities Quickly Furnished from This Tiny Electric Heater Attached to Wall Socket

Adjustable Spoon Bowl Gives Service as an Egg Beater and Is Also Useful for Basting

Anyone wishing further information on devices described in the editorial pages can

Drudgery



To Save Sewing, This Splicer Firmly Joins Rags for Rugs and Other Purposes

Light Frame Bracket and Screen for Shower Bath Completely Shields Walls and Prevents Wetting of the Floor

Can Opener Operated like Pair of Shears Has Slightly Curved Blades Which Leave Clean, Smooth Cut

Artistic Wire Clock Frame for Covering with Decorative Fabric or Parchment

Twisted Clothesline Eliminates Use of Pins; Articles Are Fastened between the Strands

Spoon with Square Edge and Perforations Permits Tasting Liquids and Solids

obtain it by addressing the Bureau of Information, Popular Mechanics Magazine, Chicago

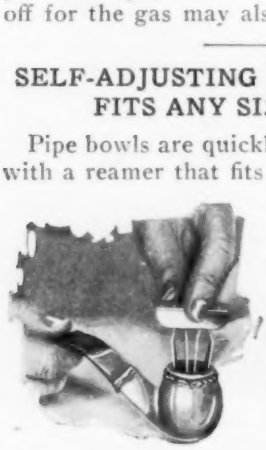
Pouring Rubbish from Metal Basket into the Incinerator, Which Destroys the Material without Any Odor

GARBAGE BURNER FOR HOME ELIMINATES ODORS

Garbage and other refuse are said to be destroyed economically and without odors in a gas-burning incinerator, intended to be placed in the basement and close to a chimney where a good draft will be available. It has a capacity of about four bushels, a week's deposit for the average family, but occupies only two square feet of space and is said to use but little gas. It is filled from an enameled basket, which is to be kept in the kitchen, and is easily put into operation. An automatic shut-off for the gas may also be obtained.

SELF-ADJUSTING PIPE REAMER FITS ANY SIZE BOWL

Pipe bowls are quickly and easily cleaned with a reamer that fits snugly against the sides of the bowl and is worked to the bottom simply by turning it around. Carbon and other waste matter are scraped away. The cleaner is self-adjusting so that it fits all sizes of pipes, large or small, without injuring the wood.



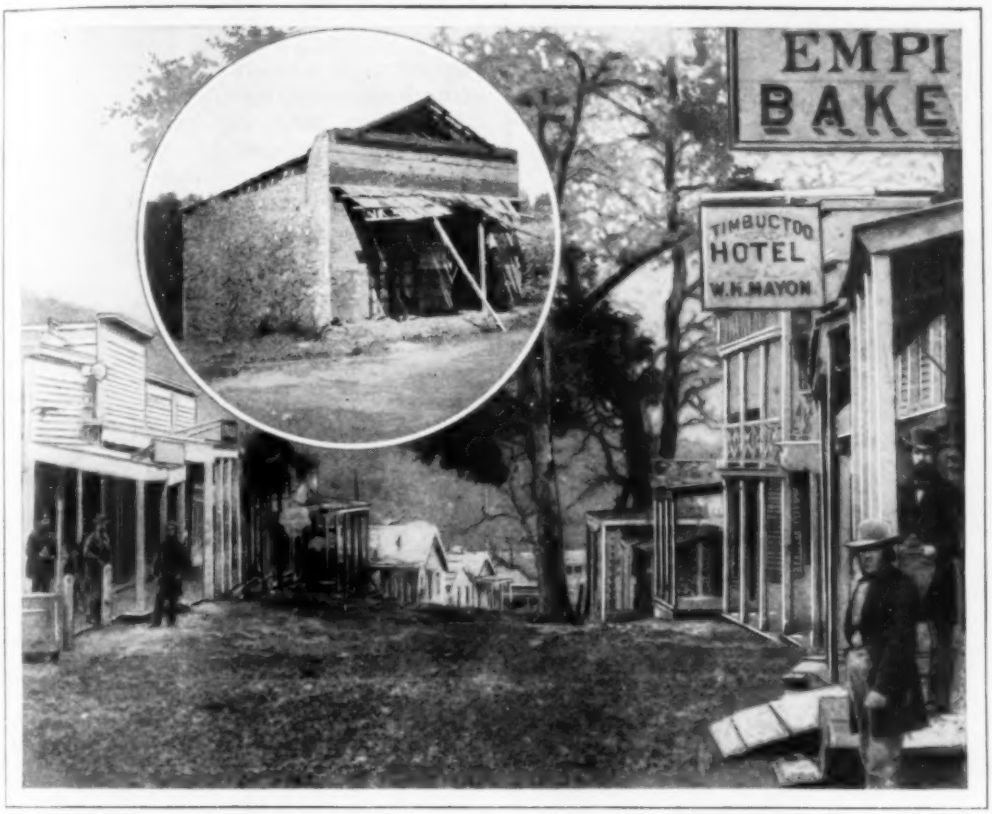
HERO OF DEATH DIVES TELLS OF HIS SENSATIONS

Besides performing a great service to aviators in testing equipment, parachute jumpers have exploded some of the myths about falling from high places. It was once a common belief that if a person fell from a very tall building, he would be unconscious before reaching the ground because of his rush through the air. Capt. H. Spencer, an English parachutist who has made more than 180 head-first leaps from airplanes, testifies that he is clear-headed even after a drop of nearly 1,000 feet before pulling the cord. There is no feeling of mental confusion or dizziness, he says, although the sensation of falling is present. Estimating the distance dropped, enables him to pull the cord at the right time. This calculation is not always easy, as no objects go flashing past to help judge the speed, and the jumper is alone in the empty air, often looking upward to see how the rigging functions. Some parachutes are made in three units, a pilot bag which comes out first, dragging a larger or shock support, followed by the third or main umbrella, large enough to check the descent sufficiently to prevent a violent fall to the ground.

WRENCH FOR AUTO HEADLIGHTS WILL NOT MAR METAL

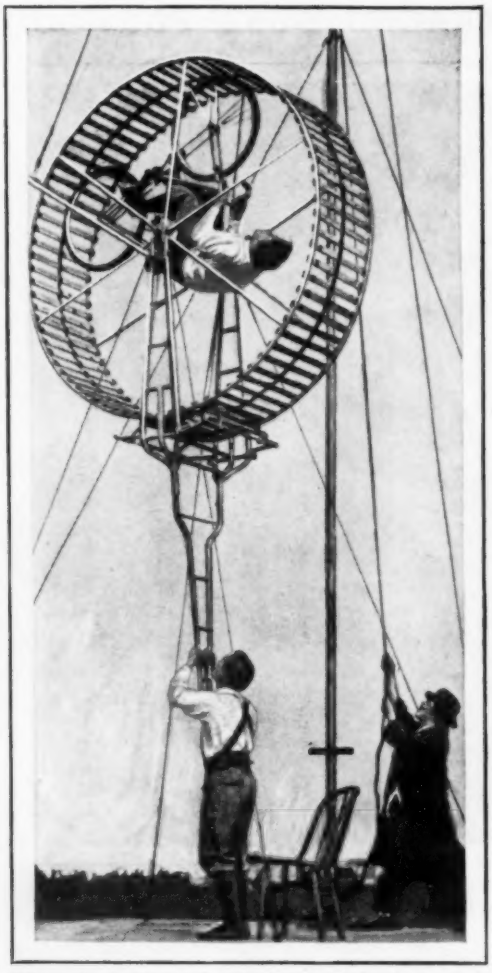
Headlight rims are quickly and easily removed without scratching the finish by means of an adjustable wrench consisting of a strip of strong fabric and a lever with protruding points on one side. The strip is formed as a loop about the rim, passed through a link at the head of the lever, where the points come in contact with the wrench to help tighten it. It fits different sizes of lamps and can also be adapted to turning other objects.

WHERE BEARDED MINERS TRADED "DUST" FOR FOOD



A Glimpse of Timbuctoo, Calif., as It Looked in the Days of the Forty-Niners; Inset Shows the Ruins of the Town's Commercial Center Where Gold Dust Was Bought

Only time-worn ruins of the town of Timbuctoo remain in the northern mine country of California. History says that a group of "State of Mainers" set that thousand-year-old desert name down in the foothills, when they came with pan, pick and shovel to do the first placer mining in 1849. Timbuctoo itself, once gay with work and play, is now but a memory and a name—a mere dot of a cabin perched on the point of a hill to the right; a barn, a well—once the village pump—and a tree-shaded home on the left, and the sturdy ruins of the building which once centered the commercial life of the town. Of brick and native stones, its iron doors still on guard, it has held its own. Painted on the space between the doors with pigment to which time and weather alike have been as nothing, is a sign that still announces to a curious world: "Gold Dust Bought." A copy of an old picture shows that once oak trees grew undisturbed in the street of the town, shading and guarding the old bank. To Timbuctoo, as to many other camps in the days of '49, came first the placer miners. They worked the surface. Next, because this method was too slow and the results too small, ingenuity worked out the hydraulic process which tore down whole hillsides into the sluice boxes where the crosswise riffles caught the gold from the rushing water. Then the white miners left and the Chinese came, content to work slowly where others had rushed. At one time there were more than 500 of them, it is said, patiently working the old tailings over and over again until, the profits becoming too scanty, they, too, moved on, and Timbuctoo went quietly down the years, remembered only by a name.



Where Strength and Steady Nerves Defy the Laws of Gravity; a Novel Bicycle Act in Progress

DANGEROUS ACT IN BALANCING TESTS ACROBATS' SKILL

Looping the loop on a bicycle while his companion supported and partly balanced him and his circular track, was the feat performed by one of a team of acrobats. Guy ropes fastened to the runway helped keep it steady, but the bulk of the weight of track and rider rested on a frame supported by the second man.

ANTICS OF ANTS

One of the most interesting species of ant is the so-called "umbrella" variety, found in South America. The name probably originates from the way the insects carry their loads over their heads like a shade. They build huge mounds, some containing as much as 200 cubic yards of material, and can strip a good-sized orange tree in a single night. A colony includes queens, drivers, workers and builders. They make well-beaten paths into the forests, four or five inches wide, in search of food. Sometimes, one of these paths will be lined for half a mile or more, with ants busily carrying their burdens, while countless thousands are swarming in a doomed tree and in the mound. They dislike water and, when rain starts, hurriedly drop their loads and seek shelter.

EIGHTY-ONE-STORY BUILDING UNDER WAY IN DETROIT

What will be the world's tallest building, eighty-one stories high, is under construction in Detroit, Mich. It will be known as the Book tower and will top the Woolworth building in New York by nearly 100 feet. The main portion of the structure will include forty-two stories. On the top of the tower will be placed a gigantic searchlight expected to be visible for more than seventy-five miles. Modern Gothic will be the architectural style.

HAMMER HAS CHANGEABLE TIPS FOR DIFFERENT JOBS

Several hammers are combined in one tool that has interchangeable tips which are screwed in place between the two halves of the hammer head. The tips are of copper, lead, or rubber. The hammer is intended especially for toolmakers, repair men and die makers.

Hammer Complete, a Cross Section, and Set of Tips That Can Be Adjusted for Different Tasks

Models of Atomic Structure, Which Indicate to the Synthetic Chemist What He Must Do to Accomplish His End; Roughly, They Represent in Tangible Symbols, How Atoms Combine with Each Other to Form Different Substances

What Chemistry Is Doing for You

Modern Wonder Workers Turn Milk into Umbrella Handles and Oat Hulls into Radio Dials

IT has been many years since the alchemists of old sought in vain the secret of changing base metal into gold.

Since that time chemists have learned to make artificial silk, rubber, dyes and have created any number of things that never existed before. In many cases they have not only succeeded in duplicating the product of nature's laboratory—they have actually made stronger, purer and more lasting things than nature.

Just a few of the many miracles of chemistry are the making of buttons from corncobs, umbrella handles from milk, poker chips from cheese, radio dials from oat hulls, meringue from beef blood and furniture from carbolic acid. Not only are handsome pens and pencils products of milk, but so are the "pearl" buttons on a shirt, buckles on milady's shoe or the back of your waistcoat, cigaret holders, ladies' beads, toilet articles, umbrella handles, electric switch plates, mah-jong counters and lots of other things of everyday usefulness. The hard buttons on your overcoat, the handle of your penknife, billiard and pool balls, even the radiator cap and timer of your car—very possibly your pipe, too; anyway, a host of other things in ordinary use are apt now to be made from the hulls left when your breakfast cereal is milled.

Even the rich yellow of the lemon is merely a matter of chemical artifice. The fruit of the lemon tree contains more citric acid—which is what the housekeeper buys it for—just before rather than after it is fully ripe, hence it comes from its native habitat a brilliant green which the sun has had no chance to turn yellow. You would not recognize it as a lemon, nor would you buy it. So the "true lemon color" you do know is obtained by its later exposure to ethylene gas.

The meringue on your favorite lemon pie is quite likely not white of egg at all, but beef blood from a slaughterhouse. Then there is a glass which will bounce

like a rubber ball when dropped on the floor; artificial fabrics which include not only the "silk" with which we are becoming familiar, but artificial cotton as well, and even wool; enduring "paints" which are not paints at all in the old sense and synthetic colors with which nature has had nothing to do; sirups which never crystallize (turn to sugar) so that candies made of them remain fresh indefinitely, and their heavy cream centers may actually be turned to liquid after the chocolate exterior has set.

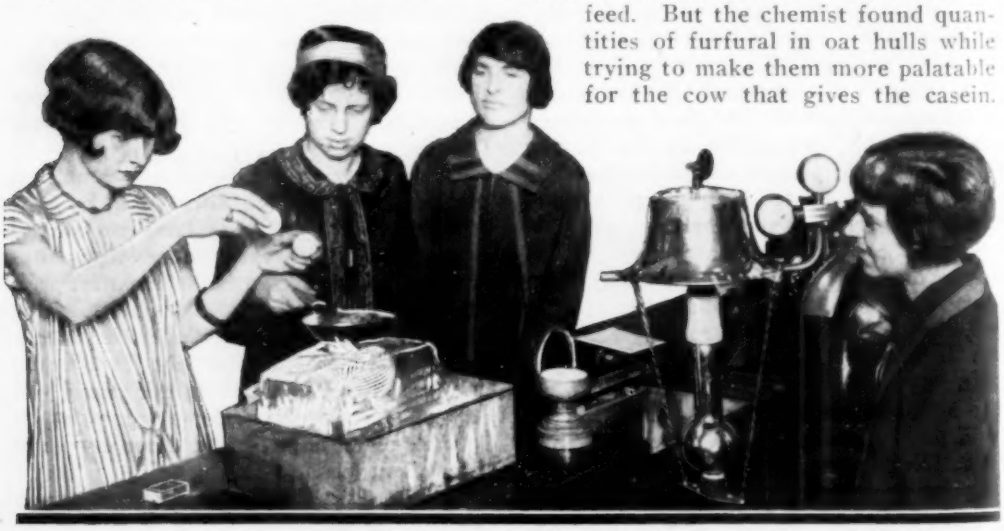
Twentieth century chemistry is modern magic. The American chemist of 1926 is a wonder worker beside whom magicians and alchemists of the past simply fade out of the picture. In laboratories far from the rush and bustle of life, a thousand and one chemists dig deep into nature's secrets, and humanity is forever being made more comfortable, given greater conveniences and made more efficient through practical application of what they learn. Always, too, some waste product or by-product, hitherto discarded, is being put to splendid, practical uses. However startling the statement may seem, it is a fact that there has been more progress in chemistry in the last ten years than in a thousand years before.

"Nor is it fair to deprecate chemical products as substitutes," says Dr. John E. Teeple, treasurer of the American Chemical society. "If a genius creates something which has the exact properties required, and is possibly better suited to its purpose than any natural product, he has given the world that for which he should receive high praise.

"To illustrate," he goes on, "take dyestuffs. Valuable land can now be devoted to the raising of food which formerly was given over to indigo, madder and other vegetable dyes, for we now replace those with synthetic dye materials which are better in many ways."

Fountain pens, buttons and poker chips from cheese! That's karolith—triumph of American chemistry—made of casein. Chemists worked it out after five years' trying. Casein is one of the products of milk, and skim milk, from which the butter fats have been removed, is largely casein and water. The farmer feeds skim milk to hogs and throws out barrels of it. Chemists coagulate casein by adding the same rennet used in cheesemaking and get a rubbery mass. A chemical then turns this product into a tough, hornlike material with astonishing strength.

These technicalities may sound dry, but we are about to connect up your coat buttons and the oat hulls and corncobs. Enormous quantities of oat hulls come from breakfast-cereal manufacture, a half million pounds or more a day, with little value as fuel and not much more as cattle feed. But the chemist found quantities of furfural in oat hulls while trying to make them more palatable for the cow that gives the casein.



Courtesy Cory and Caylor

Cooking an Egg over Liquid Oxygen, Prepared in Apparatus at Right, at 300 Degrees below Zero, and Contained in a Hole Chopped in Block of Ice

Meantime government chemists were learning the trick of getting furfural in paying quantities from corncobs, too.

Furfural has many uses. It is an excellent germicide and disinfectant, a superior base for certain dyes, and an admirable solvent for use with paint which is sprayed on instead of being brushed. Such paints dry by evaporation, leaving a permanent coating that practically unites with the original material.

Then there is bakelite made from carbolic acid. It is named for Dr. L. H. Baekeland, of Columbia university, who invented it. Besides coming in solid form it can be used as a liquid in varnish, enamel, lacquer, and so on. More fascinating is the likelihood that we shall make furniture of bakelite and similar substances, which can be cast or machined in almost any form, are proof against acids and, what is more momentous, against scratches, take a high polish and can be produced in every conceivable color. Chemists making furniture for us from carbolic acid! It has already been done and will be done commercially soon.

Soon, too, some names must be found for artificial wool and artificial cotton, which are coming fast, as yet largely as a by-product of the vegetable silk industry. Think of wood being transformed into a soft, fleecy "lamb's wool"! As for artificial cotton, much of the absorbent we now use is actually made from wood fiber. The ever-present chemist again.

America needs much more white of egg than the American hen produces—though she does very well of yolks—and has imported annually tons and tons of albumin from China, which the Chinese gather from sea birds' eggs and dry. Now come the chemists who get excellent and wholesome "white of egg" from the blood of the Texas steer.

But for the chemists, who have given us the tungsten filament and the gas-filled electric lamp, Americans would annually pay a billion dollars more than they do now for the electric light we use; that is, if we were restricted to the old carbon filament lamp of past years.

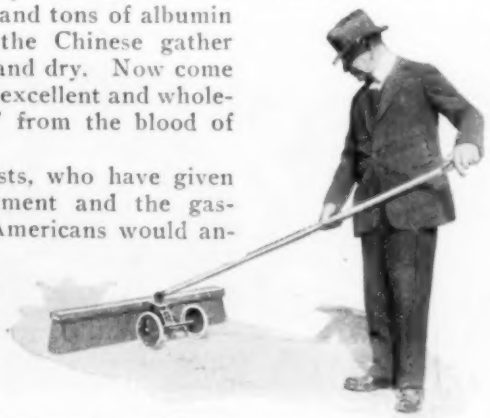
Inspecting a Sample of Oil, and Drawing Off a Portion from the Crankcase for Test

TESTER FOR CRANKCASE OIL PREVENTS MOTOR ILLS

If the crankcase oil needs renewal, the fact is quickly learned with a tester designed to show if the lubricant is too thin, worn out or otherwise likely to cause the ills that attend old oil. A small sample, drained into the tester, is sufficient, and the result is quickly obtained.

BIG BROOM ON RUBBER TIRES SAVES WORK IN SWEEPING

Mounted on a two-wheeled, rubber-tired carriage, a big broom for sweeping walks or floors need not be lifted after each stroke and is easily pushed. A rearward pull of the handle is all that is necessary to raise the bristles, and a forward shove lowers them to working position. The broom is reversible and adjustable for wear on the fiber. At least fifty per cent more surface can be swept by one person with this arrangement, the manufacturers claim.



Wide Broom with Its Rubber-Tired Carriage Is Easily Pushed and Cleans a Large Area

Fine Lenses in the Rough; Glass Nuggets Being Broken Up into Pieces Suited for Grinding

NUGGETS OF GLASS BROKEN UP TO FIND PERFECT LENSES

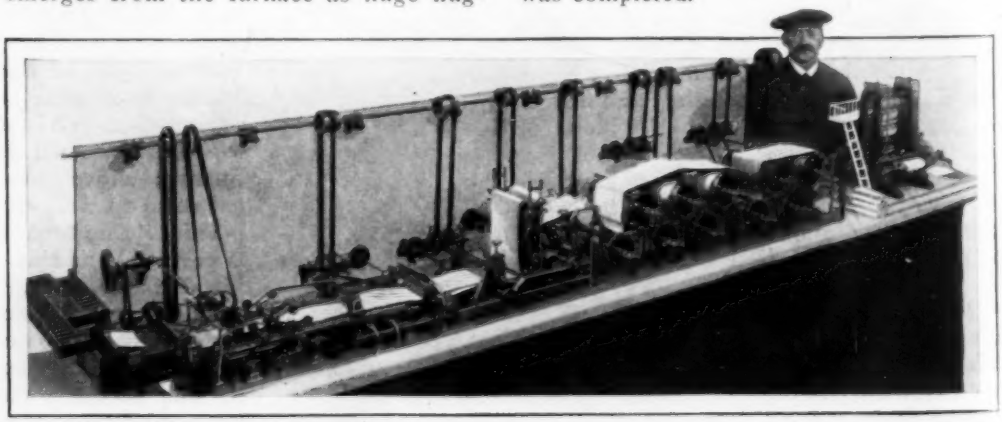
Fine optical glass for camera and microscopic lenses is now being produced in quantities in the United States as one of the results of the World war. Formerly the best lenses were imported from Germany, where lens making had been developed to a fine art, but when the war cut off the supply and vast quantities of binoculars and other optical devices were needed for the American army, an industry that now rivals the best German factories sprang up almost overnight. At a recent meeting of the Royal Society in London, tribute was paid to the remarkable way in which American glass makers had overcome all the difficulties of producing fine optical glass. In the rough, the glass emerges from the furnace as huge nuggets, crisscrossed by the fissures and lines resulting from the internal stresses of cooling. Such a nugget must be broken and rebroken until from its heart the lens maker extracts pieces of perfect glass suitable for his work.

WHAT IS A TON?

Tonnage of a ship refers not to its weight, as is often supposed, but to its carrying capacity. The term originated in the time of King Henry VII of England who introduced one of the first navigation acts of its kind in which the importation of Bordeaux wine in any vessels except those owned by his lieges was forbidden. The liquor was carried in huge barrels called tuns and, since then, the cargo capacity of a ship has been measured by tunnage or tonnage, the modern term. In connection with war vessels, however, the word refers to the weight of the water they displace, or their displacement tonnage, the common way of describing the weight of other ships.

PAPER-MAKING MACHINE MODEL FORMS FOUR-INCH STRIP

Many models of industrial apparatus merely illustrate the movements of the larger units, but a tiny paper-making machine, constructed by French experts, actually makes paper. It yields a sheet four inches wide and the entire mill is but two feet wide, two feet high and nine and one-half feet long. It took builders some twelve years of labor before the model was completed.



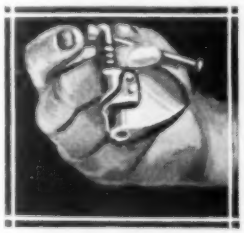
Model Paper Mill in Action; It Duplicates the Larger Units in Practically Every Detail, Making a Strip of Real Paper Four Inches Wide; the Machine Is Less Than Ten Feet Long

BORE HOLES AROUND VOLCANO TO STUDY ERUPTIONS

In the belief that changes in temperature will be more easily determined and thus the likelihood of eruptions foretold, scientists, under the direction of Dr. Thomas A. Jaggar, have bored a number of holes ten feet deep around the crater of the Kilauea volcano on the island of Hawaii. The openings are cased around the top and capped so that temperature tests may be taken at any time. It is thought that a rise in the mercury would presage an eruption and thus a "log" of the life of the volcano would be afforded. The holes are 1,000 feet apart and were dug with compressed-air drills.

VEST-POCKET SIZE HAND PUNCH IS USEFUL IN HOME

For the mechanic and home worker, a small punch now on the market is said to penetrate readily sheet material up to about three-thirty-seconds of an inch in thickness with a minimum of effort. The punch itself is contained in the end of a threaded screw which has a small lever handle for power. The die into which the metal is forced, is in the base of the frame. A gauge prevents forcing in sheets too thick to be penetrated, and the entire punch is so small that it may be carried conveniently in the vest pocket.



UMBRELLA TO MATCH RAINCOAT CONTAINS RUBBER FABRIC

In the wake of the brilliant-hued raincoat has come the umbrella to match, a rubberized article that is said to weigh no more than the ordinary kind and has a soft, velvety finish, without the glaze sometimes considered an objection in material of this kind. The frame is strongly constructed with ten ribs, and the umbrella is furnished in a wide variety of shades ranging from blue, green, red and other plain colors to plaid.

Illustrating the Way Rake Is Used, and Close View of Teeth Reaching between Shrubbery

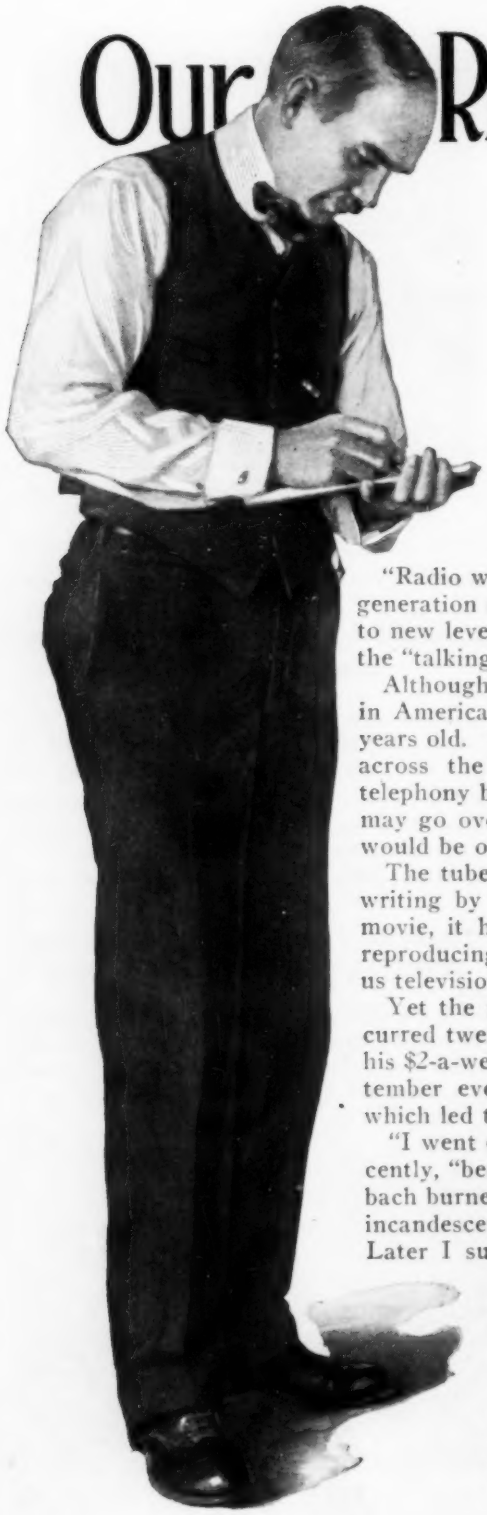
LAWN RAKE WITH LONG TEETH USED LIKE BROOM

Equipped with long, steel tines that reach in between the shrubbery and do not tear up the sod, a special rake for lawns is wielded with an easy sweeping motion, does not become clogged readily and stirs the soil without injury. The tines are fitted securely into a steel yoke.

CORRUGATED-METAL SHEARS CUT WITHOUT DISTORTION

In cutting sheets of corrugated metal, the edges are usually bent out of shape and have to be straightened. This is said to be unnecessary with a lightweight pair of shears, nearly small enough to be slipped into the pocket, which cut straight, on curves or obliquely across the sheet without distorting the corrugations. It has two rotary, double-edged cutters, knurled on the shearing edges, and is held to the metal by means of a screw cap, which may be quickly loosened when the operator desires to withdraw the shears.

Our RADIO WORLD



Dr. Lee De Forest Forecasts Future Developments in Wireless

By J. OLIN HOWE

WHAT is on the radio horizon? And beyond it? What lies over the hill?

"Radio will be as much a commonplace with the next generation as the telephone with this, lifting civilization to new levels," answers Dr. Lee De Forest, inventor of the "talking lamp," the radio tube known as the audion.

Although more than 3,000,000 radio sets were placed in American homes last year, the tube is only twenty years old. Without it we should be unable to telephone across the continent, and multiplex telegraphy and telephony both—by either of which numerous messages may go over the same wire circuit at the same time—would be only a dream.

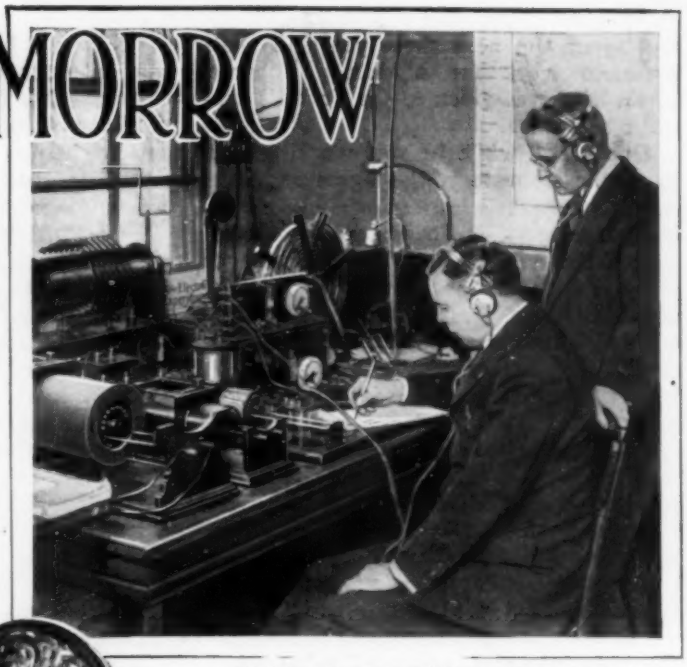
The tube makes possible the sending of pictures and writing by wire or by wireless, it gives us the talking movie, it has revolutionized the art of recording and reproducing sound by the phonograph, and it will give us television, and much besides.

Yet the real birth of radio as we know it today occurred twenty-six years ago when De Forest, sitting in his $2-a-week hall bedroom in Chicago on a warm September evening, first observed the "Welsbach effect" which led to the invention of the talking lamp later on.

"I went crazy mad over that," Dr. De Forest said recently, "because the fluttering of the flame in the Welsbach burner gave me the idea that heated gas around an incandescent mantle might be sensitive to wireless waves. Later I substituted the filament in the electric lamp."

De Forest was hardly more than a year beyond his graduation from Yale at the time, but had been out in the workaday world long enough to find that his degree got him very little there. An electrical company was willing to pay him $8 a week and he eked out this income by translating French articles for a technical publication and by teaching nights. It was the same company that later paid him

# of TOMORROW



Old-Time Receiver and Dr. De Forest at a Modern Set; Swift Radio Changes of Recent Years

something like 50,000 times the amount of this his weekly salary for the right to use his tube in the telephone business. Not at once, however, did De Forest perfect his invention and certainly not for many a year did recognition come to him. Men of science and captains of industry scoffed at the "useless toy."

As recently as the summer of 1912, De Forest, having already lost two fortunes in experimental work, was employed as a research engineer of a California company at a small salary. He needed $125 to save his French patents and went to the president of the company he worked for to borrow this sum. In return, De Forest offered a half interest in his French rights. The president thought it too much of a gamble and, to the despair of the inventor, his French patents reverted to the government. Two years later came the war and the magic tube took its place as the very heart of military communication. Countless bulbs were supplied the allied armies.

De Forest sighs in recalling this. "One million dollars is a conservative estimate of the royalties which would have been paid during the war years, if I had been able to hold on to those French patents," he says. "Unfortunately my friends believed I was only dreaming."

An eminent professor of electrical engineering had thought even less of the ideas of the student, De Forest, years before. The latter graduated from Sheffield scientific school in '96

and spent the next three years in post-graduate work for a doctor's degree. Little heed was given to De Forest's fantastic research.

One night, while he was working in a basement laboratory, the lights suddenly went out in this professor's classroom. He suspected De Forest of having removed the wrong fuse, but could never prove it. Shortly after, however, he found that De Forest had nailed his apparatus to a laboratory table. This was too much. "A student who will spoil a table like that," said the professor, "will never amount to anything."

Much time elapsed between the observing of the Welsbach effect and the actual production of the vacuum tube in 1906. This tube, about the size of an Edison lamp, contained a filament, a grid and a plate and De Forest coined a name for it from "audio," to hear, and "ion," meaning one or more electrons. The three-electrode tube thus became the "audion."

In 1912, the telephone company, seeking to extend its long-distance service, purchased the audion patent rights for $140,000. In less than two years, they were able to open service across the American continent. Later the same company paid $250,000 more, for the little lamp had grown from a mere child of imagination to a full-sized servant of mankind. It relayed wireless dots and dashes across the sea and it carried the human voice on telephone wires over the land.

"Now we have all there is under the audion patents," said a leading telephone attorney to a friend of De Forest.

"But not the exclusive right to sell radio sets to the public. De Forest retains that."

"What does that amount to?" cried the other in derision.

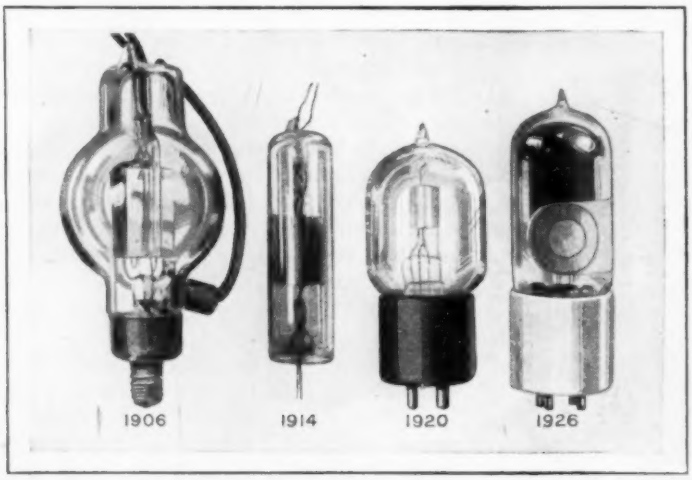
True, what did it amount to nine years ago? Broadcasting, actually first done publicly when, on July 15, 1907, the races of the Inter-Lake Yacht association at Put-In-Bay on Lake Erie were reported by radio, was a joke in 1917. Even three years later, on Nov. 2, 1920, when KDKA of East Pittsburgh went on the air as the first regularly established broadcasting station, radio was still something of a joke. The owners of the station had decided there was a future in radio, and had made up fifty sets, and induced fifty wealthy men to spend $100 each, though the purchasers believed they were throwing their money away.

And of broadcasting, 'way back in 1907, De Forest had said: "Church music, sermons and lectures can be spread abroad by the radio telephone. In the rural districts scores of individual radio-telephone services can be maintained between widely separated farms, ranches, crossroad stores, etc. For the distribution of music, the radio telephone means an enormous increase of patronage among music lovers."

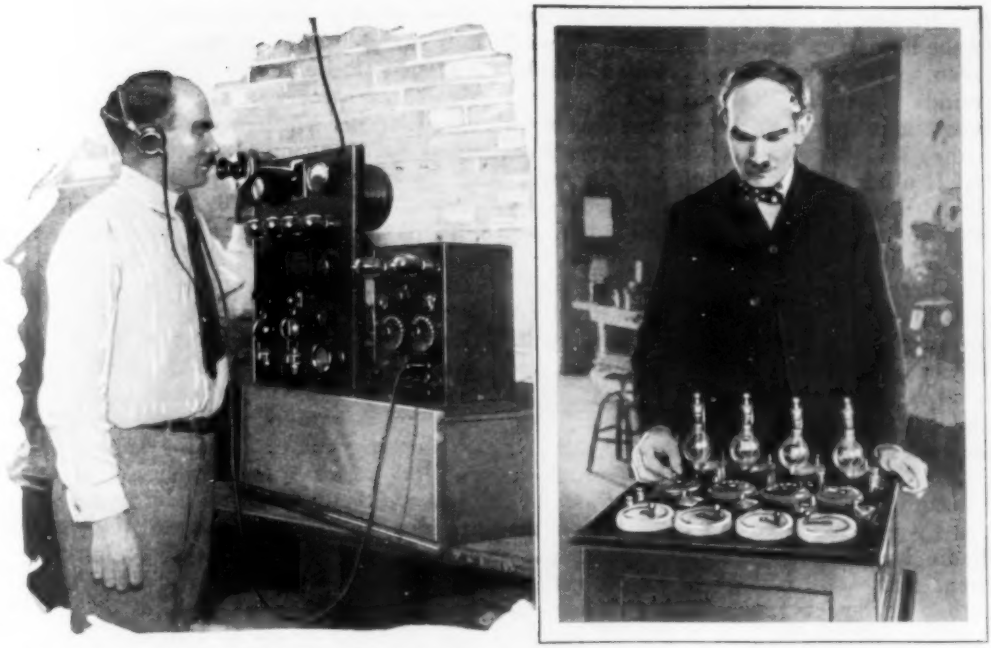
But De Forest visions still greater developments in the next few years.

"Amazing improvement in the quality of reception is a matter of the near future, and it must come," he says. "Instead of many tubes, we may substitute one big tube which will do its work much better. The photo-electric cell may give us television.

"Broadcasting will take on entirely new phases and conceivably the national government may take over all broadcasting of a general or public nature. We shall have radio schools—a whole system of education in which all instruction is given over the radio, and



Another Illustration of Radio's Rapid Development; Changes in Tubes, the "Talking and Listening Lamps," since 1906



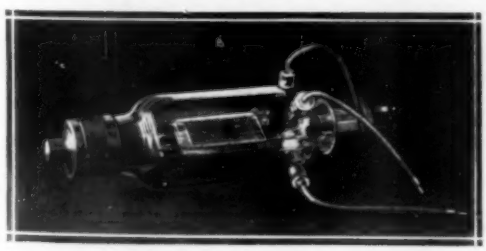
Two Pioneer Sets of Apparatus, Yet Each Is But a Few Years Old; at the Left, Dr. De Forest at His Wireless Telephone of 1919 and, at Right, an Audion Hook-Up of Yesterday

we shall have radio newspapers and magazines, and perhaps a radio church.

"Radio telephony and wire telephony will be linked up to a degree which will make it possible for us to listen to broadcasting over our telephone wire, and doubtless plug in a loud speaker on a telephone circuit.

"While it has already made itself indispensable in our daily lives, it is a fact that radio is yet in its merest infancy. The task directly ahead is to improve the speaking and singing voice of radio.

"There is no set today which, with its loud speaker, gives perfect reproduction of music. Every set, and many loud speakers, distort the sound in some way. Designers have been too economical, have sought to make one tube do the work of two, have tolerated back-feeding—have failed sufficiently to shield the various elements. We must remember this, though, that in radio the extreme sensitiveness essential to true reproduction calls imperatively for good broadcast reception. The loud speaker cannot make up for deficiencies in the receiving set. Here we come to the limitations on the number of tubes which can be used to advantage, and we run into difficulties in the multiplication of tubes which seem likely to be overcome by the use of one large audion equivalent to several smaller ones, with diverse steps of radio-frequency amplification in the same tube.



Early Vacuum Tube Dr. De Forest Developed for Sending Messages; He Called It the Oscillion

"Now something about static? Unfortunately man doesn't subdue the forces of nature which he learns to utilize. At least, not in his present stage of development. He doesn't even adapt them; he adapts himself to them.

"Can we conquer static? Probably not, put as baldly as that. At least, not for a very long time. But we can learn its diagnosis, as we have that of lightning, and how to insulate ourselves from it and, somewhat, to keep out of its way.

"To me the delightful thing about radio is that it enters so indispensably into

modern life. It extends the hearing power of the human ear around the earth, or will do so, to enable anyone to listen to audible sounds anywhere else. Some day in the future man may even go out from his own planet and beyond his own atmosphere and if other planets are inhabited by sentient beings, he and they may find it possible to communicate. But not by radio as we know it today.

"There are far more interesting radio possibilities—and not only possibilities, but certainties — much nearer at hand. For one thing, the range of the human ear is already increased astonishingly by it and will be more so. We hear overtones and undertones we didn't know existed.

"In New York we hear heartbeats in Chicago and the footsteps of a Washington fly walking across a sheet of paper. Radio has long since passed the amusement phase and will go down in history as one of the few revolutionary devices in human progress. Think of listening in on a tiger hunt in India, or an elephant hunt in Africa—on war and all that goes with it—on parliamentary debates and world events of any important kind. All this will come.

"Television we have now, in a way. At all events, by using the photo-electric cell and boosting its frequency many times higher with the audion tube we can transmit pictures and writing, either by wire or by air. This will become a commonplace in its turn and checks drawn in London or Paris and transmitted by radio will be cashed in New York or San Francisco.

"It is even said that a coronation in the first-named city may be pictured in New York theaters the same evening. Before such a feat is possible, however, coronations may have gone out of fashion. Yet the transmission of still photographs is already by way of being standardized and sending motion pictures is but a matter of working out technical details.

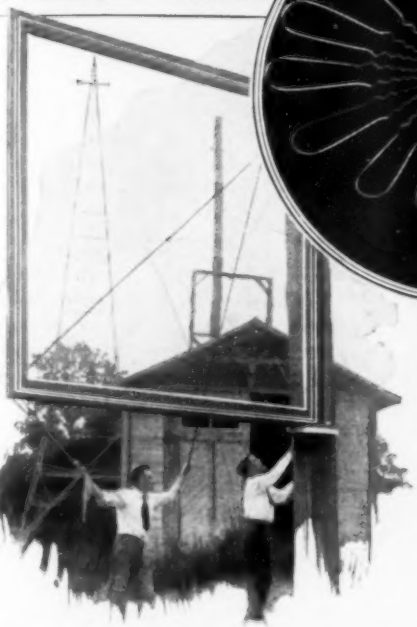
"But is this true television? By that term we really mean the ability ourselves to see over long distances. Not to be shown pictures taken far away, but to actually view the scene itself in Los Angeles while we are in New York.

"Can we ever do so fantastic a thing? Theoretically, it is possible. Commercially and financially, it is impractical. Even so, I can say that there are undreamed of possibilities in radio—possibilities perhaps limitless from any standpoint of human limitations!"

Wrapping and Packing Radio Tubes for Shipment; These Magic Little Units Are Handled Carefully as Befits Parts That Have Played So Important a Role in Radio's Progress

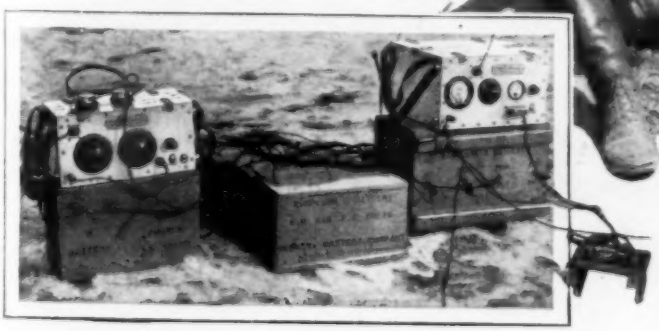
Here Are Radio's Latest Novelties

Air-Mail Pilots Equipped to Receive Radio Weather Reports; Right, Attractive Pedestal Speaker

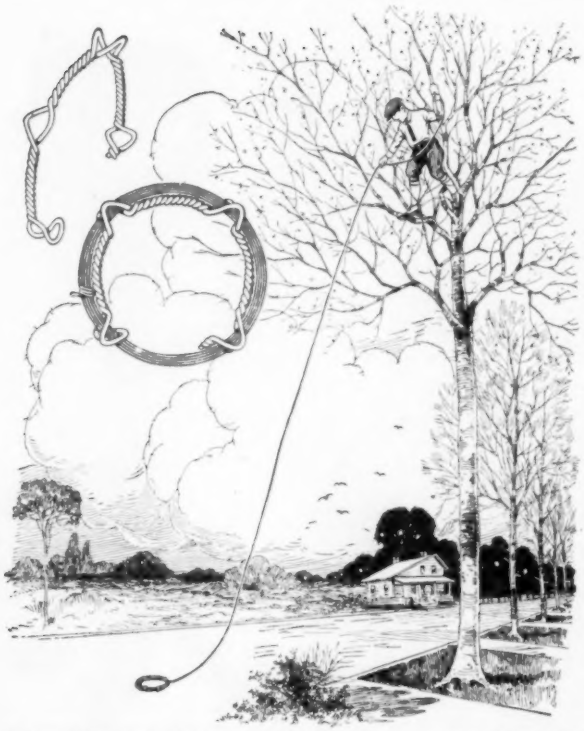


Left, Double-Coil Radio Beacon That Guides Aircraft over Its Route; Center, Parasol Aerial Looks like a Rosette of Giant Hairpins; It Is Claimed to Be More Efficient Than the Usual Aerial, with the Added Advantage of Portability

Below, Arctic Radio Equipment with Battery Supply Designed for the Detroit Arctic Expedition; It Represents the Latest Type of Low-Power Low-Wave Apparatus



Above, James Cruze, Directing Naval Battle Scene for Big Picture by Radio; This Method of Supervision Enables the Director to Keep in Constant Touch with All the Various Units of Elaborate Productions Employing Hundreds of People Spread over a Large Area



Spring-Wire Coil Holder Prevents Tangling of Aerial Wire during Installation

Spring-Wire Coil Holder Prevents Tangling of Aerial

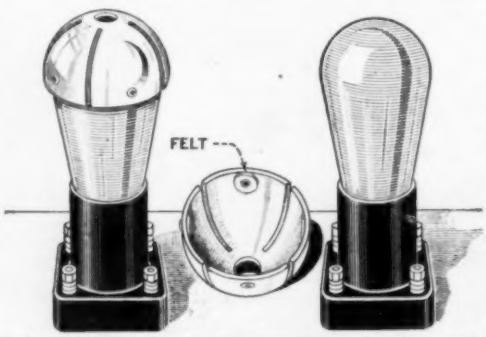
A wire coil holder that saves winding the wire on a spool and prevents tangling is shown in the illustration. If you have ever climbed to the top of a 60-ft. tree with a tangle of aerial wire hung to every limb and the wind blowing a gale, you will appreciate the usefulness of such a coil holder. The device is simple and easy to make, the construction being indicated in the diagram. It consists of a length of steel wire twisted, as shown, with the idea of making a holder of variable size, so that it will fit coils of different diameters. The wire used should be springy, and as it does not form a complete circle, it will adapt itself to the coil and hold it firmly.—Watson Brown, Iuka, Miss.

What the New Condenser Ratings Mean

A simpler method of giving the rated capacity of condensers is now in general use and marks a third step in the interest of simplicity and efficiency since the old days when manufacturers marked their condenser capacities in relation to the number of plates used. Several years ago a 23-plate variable condenser was understood to be of .0005-mfd. capacity, etc.; then this crude rating gave way to the more exact method of stating the measured capacity regardless of the number of plates. A farad is the unit of capacity, or the ability to store up electrical energy; but it is so large that radio condensers are measured in millionths of it, called a microfarad and indicated by the abbreviation mfd. Now that condensers of still smaller capacity are in general use, such as .0001 mfd., the millionth of a microfarad has been adopted as the commercial unit and is abbreviated to mmf. Thus .0001 mfd. is equal to 100 mmf.; .00004 mfd. to 40 mmf., and so forth.

Metal Cap Stabilizes Tube

A metal cap, designed to fit over the standard tube, changes the oscillation period to a point where the tube is not affected by vibrations from the set or loud speaker. The method of using the cap is clearly shown in the illustration, and is quite different from the usual devices for eliminating tube vibration. Spring-suspended and rubber-cushioned sockets often eliminate or minimize vibrations, but there are cases where heavy vibrations from machinery and traffic render all efforts useless. For these the metal cap has been designed.



Left, Tube with Cap in Position; Right, Cap Removed, Showing Felt Pads That Separate Metal and Tube

Cheap Homemade Battery Charger

By JOSEPH PAULY

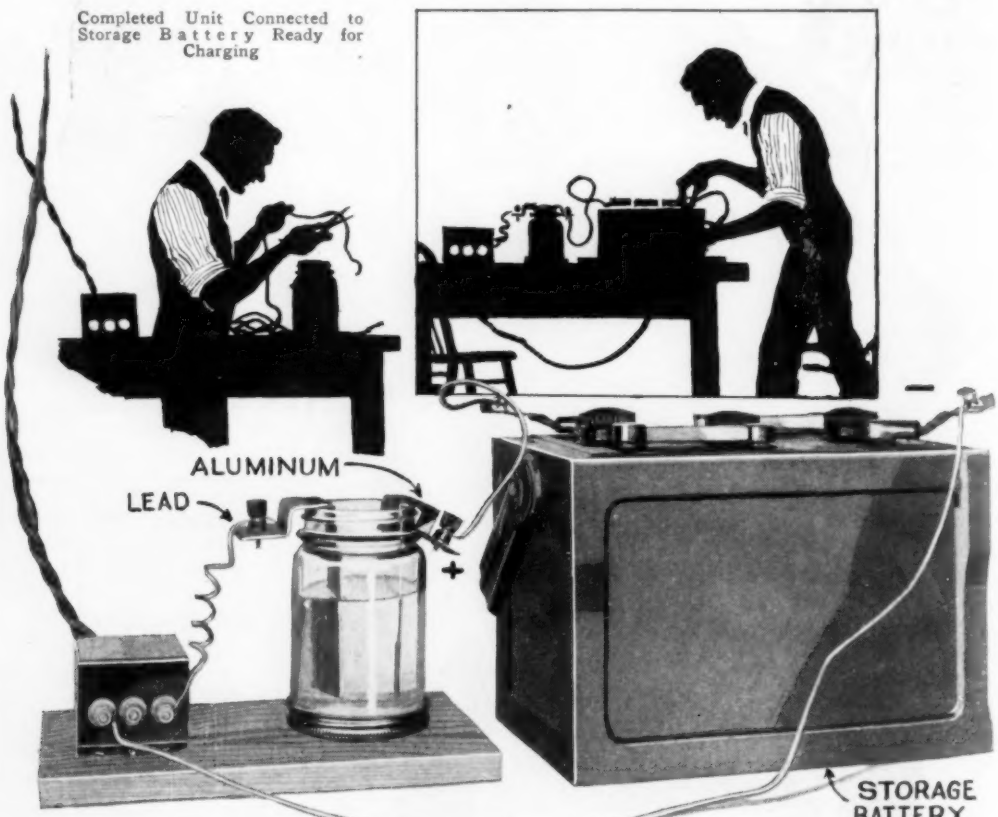
THIS simple battery charger or "booster," made from odds and ends about the average home, costs but $2.50, is extremely simple to build, and saves many trips to the battery station. It is not intended for large sets that place a heavy drain on the A-battery, as the charging rate is low, but is especially adapted for sets with not more than 5 tubes of the A-type on a 6-volt battery or those employing 199 or similar tubes on a 4-volt storage battery. It is used in the same manner as the well-known trickle chargers now on the market, and can be left connected for long periods without overheating or even getting warm. After having the battery fully charged, the author connected the little charger, placing the battery on charge when the set was not in use. The materials required are a small glass jar of the type used for preserving, a bell-ringing transformer of the tapped type, an aluminum pie plate, a strip of lead, two binding posts, a ¼-lb. box of borax and a board, ½ by 6 by 10-in., for the base. The bell-ringing transformer is of the common step-down type tapped for various voltages, usually 6, 12 and 18 volts, and may be obtained from any dealer in electrical supplies. The aluminum and lead plates are 1½ by 7 in. and are bent in the manner shown in the diagram so as to fit over the top of the jar. The former is cut from the pie plate with a pair of tin snips, and the lead plate from a 1/16-in. sheet which can be obtained at a plumbing shop. Holes

Materials Required to Build the Battery Charger; at Right, Details of Plate

for the binding posts are drilled in the end of each strip. The step-down transformer is screwed to one end of the baseboard and the glass jar is placed at the other, as shown. The jar is held in position by the top of a tin can, to prevent it from shifting about. Dissolve ¼ lb. of borax in about 1 pt. of distilled water and let it set. It will be found that a portion of the borax will not dissolve but will remain at the bottom. The clear solution should be poured off, being careful not to disturb the sediment. The sediment is then washed out of the container and the clear solution poured into it until the jar is three-fourths full. Now hang the plates in the jar, in the position shown, and connect the rectifier jar across the transformer to form the cell, using either 12 or 14 volts. The transformer is then plugged into the 110-volt line, the cell-forming process taking about 12 hours.

This forming process is necessary since, up to this point, it will not rectify alternating current; the process converts the cell, which would previously pass current in either direction, into one that will pass current in one direction only. As the cell forms, the aluminum plate will turn light gray where it is exposed to the action of the solution. This coating is an aluminum oxide, insulating the lead from the aluminum plate, when current attempts to pass from the aluminum to the lead plate, but acting as a conductor when the current passes in the reverse direction.

If, after five or six hours of forming, the aluminum plate has not turned to a light gray, but has a dark-slate appearance, the cell has refused to form. There may be one or more reasons for this; first in importance, that the water used for the solution is not properly distilled, second, that the aluminum is not pure, and third, that the plates are not clean. Remove the plates, dry and rub them down with emery cloth to remove any grease or foreign matter; make sure the aluminum, and dis-



Completed Unit Connected to Storage Battery Ready for Charging

tilled water used are pure. After the plate is formed, the charger is connected to the storage battery, as shown in the photo. The aluminum plate is always positive and goes to the positive of the storage battery; the negative terminal of the storage battery is taken to the transformer, the other side of the transformer being connected to the lead plate. A little oil on top of the solution will prevent creeping and evaporation, but the cell requires no further attention. The charger can be left connected to the battery for long periods without heating, and draw practically nothing from the lighting circuit; the charger is for 100-volt, 60-cycle alternating current only, so it is well to see what type of current is available before building the unit. Besides the material already mentioned the only supplies needed are two binding posts, and 5 ft. of ordinary lampcord, with plug.

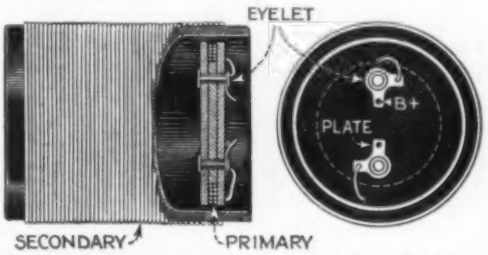
How Cell Is Connected across the Transformer for the Cell-Forming Process

Re-Marking Radio Dials

Radio dials and lettered binding posts often become darkened and worn, due to constant handling, but they can be made like new with little effort and expense. Obtain a small tube of Chinese white at a painters' supply store. Remove the old white filler from the dial or binding post with a sharp tool, a large darning needle being ideal for this purpose. It is important that the engraving be cleaned out thoroughly before refilling, or the new paint will not stick. Put in the new filler of Chinese white and allow it to set for three minutes. Now hold a piece of cloth flat on a table and rub the post or dial on the cloth to remove the excess filler.—John C. Heberger, Rochester, N. Y.

Efficient Primary for R. F. Transformers

The idea of winding the primary of a r.f. transformer in a slot or groove is not a new one, but it has the advantage of reducing the capacity coupling between the primary and the secondary. The sketch illustrates an easily made winding form for such a primary. Three round disks of 1/16-in. bakelite are held together with two ordinary shoe eyelets. Two of the disks are of the same size, the third and smaller one being placed between the other two. The three are clamped together and drilled for the eyelets, and the latter inserted and clinched over the terminals. The primary, consisting of 15 to 20 turns of No. 32 d.s.c. wire, is wound in the slot; the ends are soldered to the terminals, and the finished coil slipped inside the secondary, whereupon the terminals are connected to the B+ and plate as indicated. The eyelets which are used to hold the plates together should be obtainable at any shoe store. If 1/16-in. bakelite is not available, cardboard will serve the purpose practically as well.—Hugh G. Bersie, Chicago, Ill.



Cut-Away Section Shows Primary Coil in Position; Right, End View with Primary Terminals

EXCEPTIONAL SIMPLICITY is Feature of LATEST SUPERHET

by Frank L. Brittin

AS easy to build as the average 5-tube set, this latest product of Popular Mechanics radio laboratory introduces an entirely new note in modern superheterodyne design. The superiority of this well-known circuit is undisputed; when correctly built, it has invariably proved its right to the title "Rolls-Royce" of radio receivers. Up to the present time, however, it has been necessary for the average superheterodyne builder to follow several hard and fast rules to obtain the remarkable selectivity, tone and range for which the circuit is noted. Without facilities for carefully matching tubes, checking i.f. transformers and proper shielding, no two sets worked exactly alike; some were good and others no better than the average tuned r.f. sets, depending on the skill of the builder and the quality of the materials available.

All hit-and-miss methods are eliminated in this powerful and selective receiver, which employs a specially designed three-stage resistance-coupled unit, making possible the use of any intermediate-frequency best suited for the needs of the individual builder. In the early days of superheterodyne development, resistance-coupled i.f. amplification was used with excellent results. This method, however, was used by only a few experts, who, after many experiments, occasionally found just how much drawing ink and graphite from lead-pencil shavings would turn the trick. Today we have highly developed permanent resistor units available for all, and it is no longer necessary to depend on specially peaked and matched transformers nor upon arbitrary frequencies that must be carefully filtered out to obtain maximum results.

For the model described, which, of course, is used in the Chicago territory, a tuned filter peaking at 46 kilocycles was used, as this was found to keep at a minimum the interference due to harmonics from powerful stations in this region. While this frequency may be used in any other territory, it may be found advisable to select a tuned filter peaking at a frequency either above or below 46 kilocycles, depending on the wavelengths of the local stations. This is an easy matter, since the filters are available for any frequency, from 40 to 50 kilocycles. This makes the receiver extremely flexible, and results in greater selectivity, without sacrificing tone quality, and, at the same time, greatly increases range and volume. Perfect inter-stage amplification, due to the resistance-coupled unit and the use of extra-heavy a.f. transformers, capable of handling both the higher and lower frequencies, makes possible the true reproduction of the living voice. With a suitable

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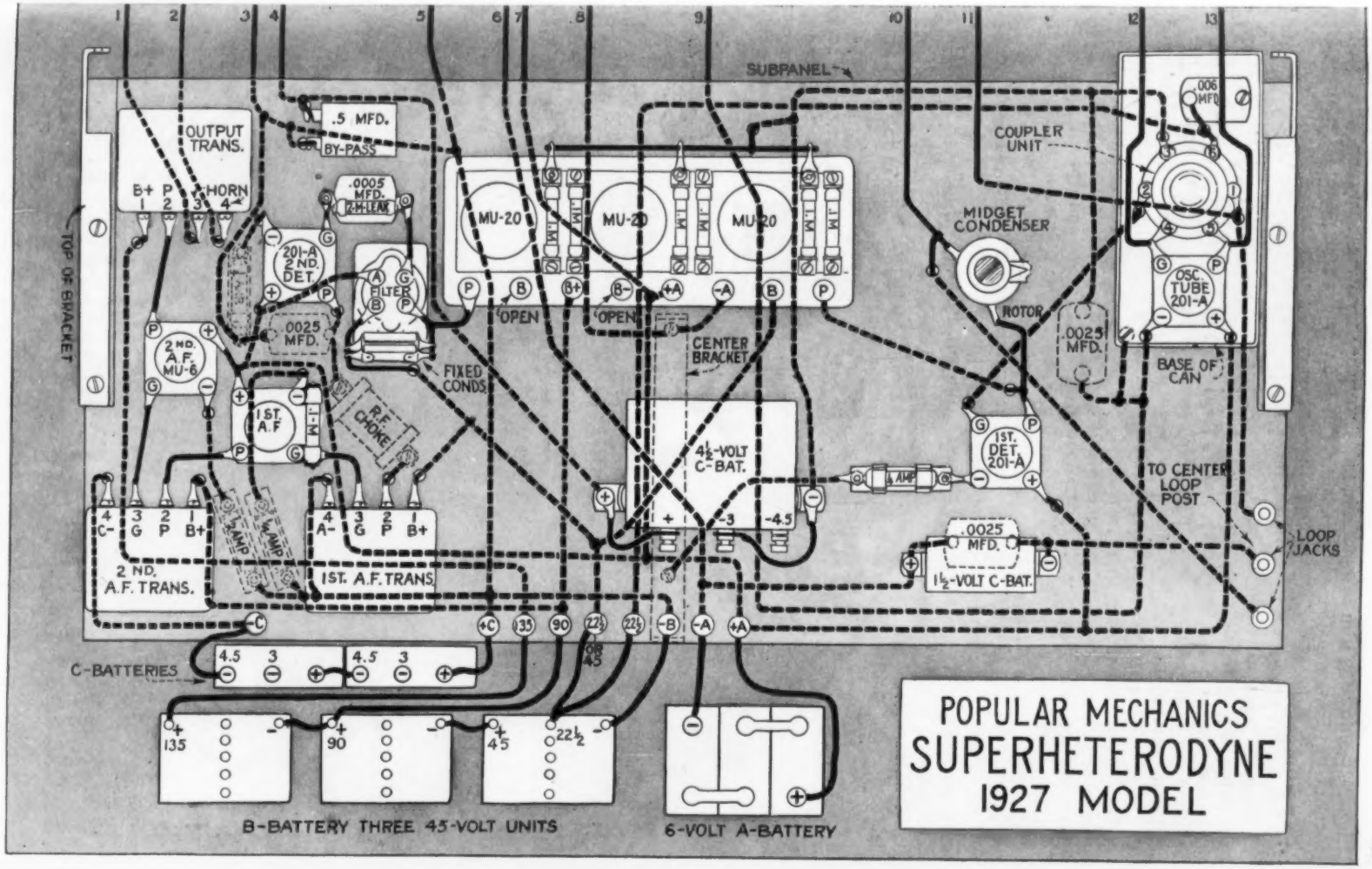
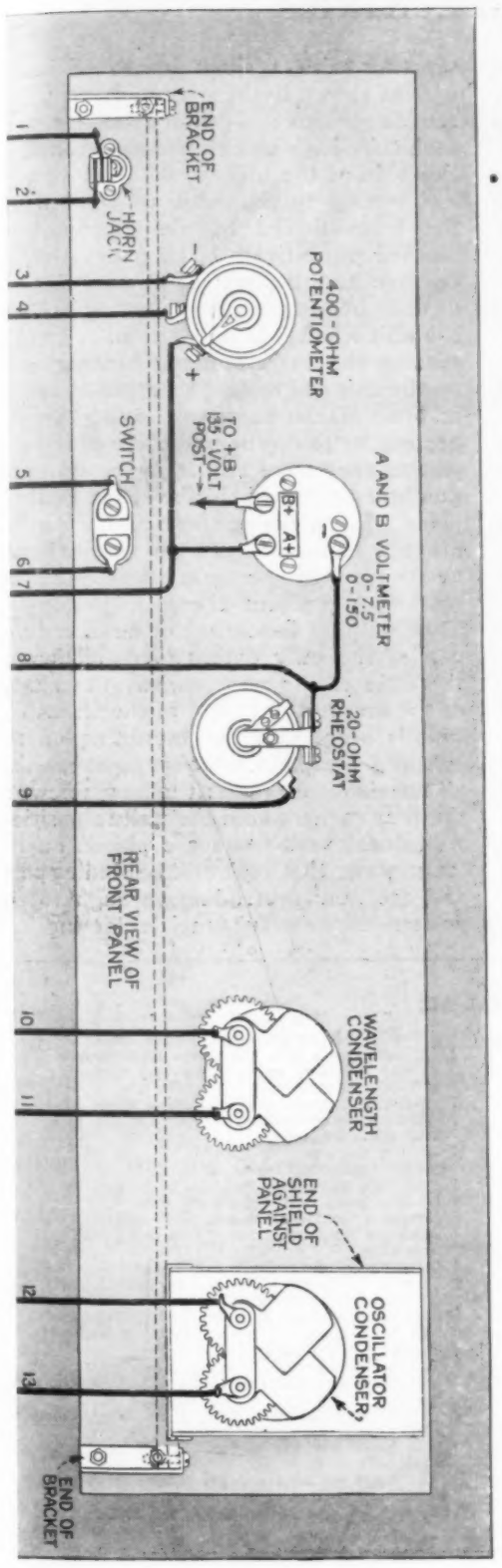
speaker or combination of horn and cone speaker in series, capable of truly reproducing the output of the receiver, each instrument in the orchestra can be heard; the low notes of the bass and kettledrums as well as the high-pitched clarinet and piccolo notes are given their true tonal values. A third transformer of the output type is used between the loud speaker and the output of the power tube; this transformer is designed to keep the direct plate-current of the power tube out of the loud speaker, thus increasing the handling power of the latter several times.

Distance tests during the summer months, usually not considered good for radio reception, resulted in a log of some sixty stations scattered over the east coast, Canada, and southern states. Most of these stations were logged during severe static disturbances and many through a barrage of local high-powered stations.

No lengthy construction data are required to build this set as each step is carefully covered in the photos and diagrams. The front-panel template should be carefully laid out on a sheet of bristol board if blueprint templates are not used; the layout of the subpanel is shown below and the holes for the instrument mounting screws indicated. Details of the subpanel mounting brackets are shown below the subpanel layout; it will be noted that strips of bakelite are used to drop the subpanel 3/16 in. below the top of the outside brackets to make room for the aluminum "can" or shield above the subpanel.

The oscillator unit is completely isolated


SUBPANEL
OUTPUT TRANS.
B+ P HORN
1 2 3 4
.5 MFD. BY-PASS
.0005 MFD. 2-MEG LEAK
201-A 2ND DET.
.0025 MFD.
2ND A.F. MU-6
1ST A.F.
R.F. CHOKE
FIXED CONDS.
FILTER
MU-20
MU-20
MU-20
OPEN
OPEN
CENTER BRACKET
4½-VOLT C-BAT.
COUPLER UNIT
.006 MFD.
MIDGET CONDENSER
ROTOR
.0025 MFD.
OSC. TUBE 201-A
BASE OF CAN
1ST. DET. 201-A
TO CENTER LOOP POST
LOOP JACKS
.0025 MFD.
1½-VOLT C-BAT.
TOP OF BRACKET
2 ND. A.F. TRANS.
1ST. A.F. TRANS.
C-BATTERIES
B-BATTERY THREE 45-VOLT UNITS
6-VOLT A-BATTERY
POPULAR MECHANICS
SUPERHETERODYNE
1927 MODEL



in this aluminum can, shown in the photo at the right. This can may be obtained with most of the holes drilled and ready for use; the top and bottom are removable, the base of the can is screwed to the subpanel and the tube socket and universal socket for the plug-in coupler unit mounted in the position shown. Three short lengths of brass tubing furnished with the unit are used to elevate the coupler socket about ½ in. above the base of the can. The tube socket is mounted directly on the can base or can be slightly raised on bakelite strips if desired. The .006-mfd. fixed condenser is mounted on the base of the can directly in front of the coupler unit under the oscillator condenser, one side screwed to the can for the A-negative connection and spaced by an extra brass nut, as shown in the detailed diagram. The other side of this fixed condenser does not touch the can and is provided with a soldering lug and connected to the No. 6 post on the coupler-unit socket. Holes are drilled in the can base and subpanel near each terminal of the tube socket and coupler-unit socket, all leads to these terminals being taken below the subpanel and insulated from the can with short lengths of good black spaghetti tubing.

Next assemble all instruments on the front panel except the oscillator condenser and screw the front panel temporarily in place on the outside subpanel brackets. When assembled, the front edge of the can base should be against the front panel. Place the sides of the can in position in the base and line up the condenser mounting holes on the front of the can. After drilling the holes in the can, enlarge the hole for the condenser shaft so no metal will come in contact with the shaft when the condenser is in position. When completely assembled and the lid in position, this aluminum can effectually shields this usually "touchy" part of the circuit. The oscillator condenser, top and sides of the can are then left off the assembly until all the wiring is completed, the last two wires from the oscillator condenser to the coupler terminals 4 and 5 being added after the can is finally assembled. The subpanel layout shows each instrument above the subpanel in its proper position; the only instruments below the subpanel being the r.f. choke coil, by-pass condensers and filament control ballasts shown in the large wiring diagram and indicated by

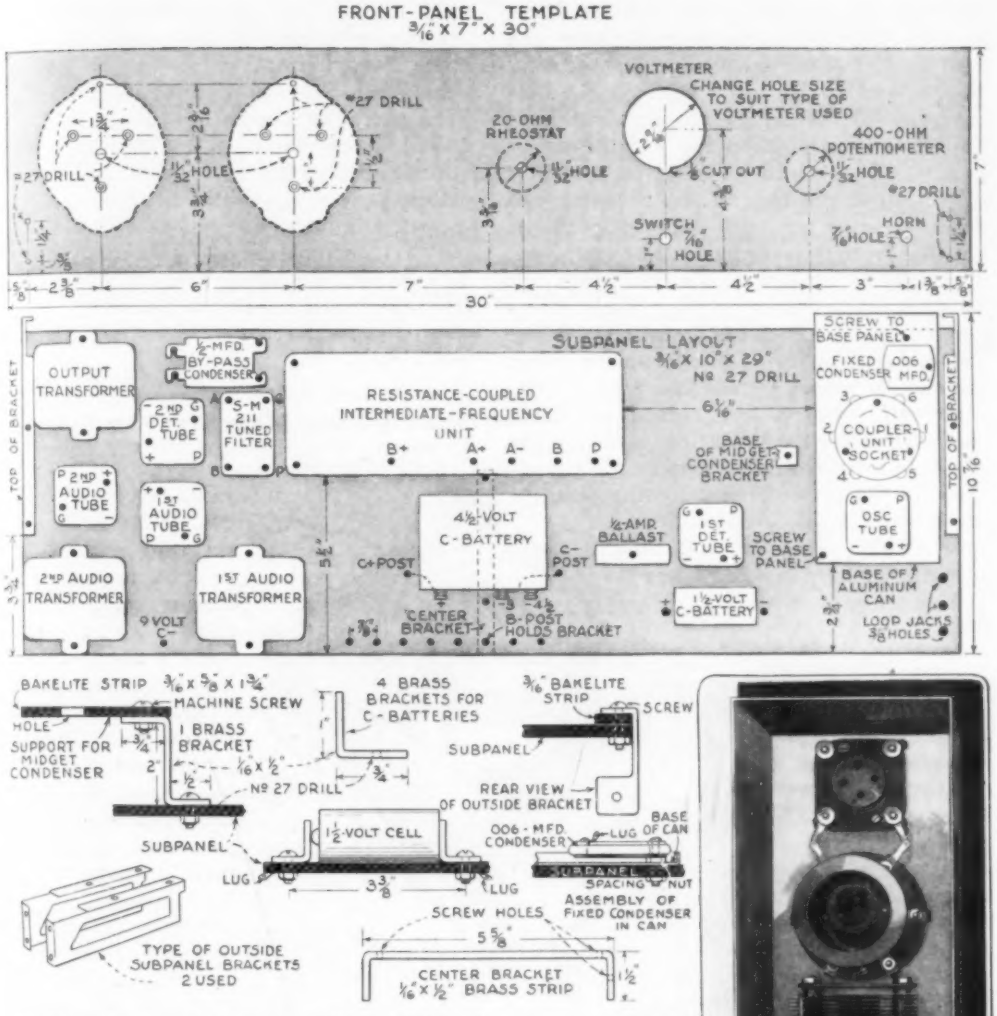
dotted lines. The ballasts are all below except the one for the first detector tube; a single brass machine screw holds each ballast mounting in position on the subpanel, and the choke coil is held in position with a short brass machine screw at each end, as indicated. These ballasts are ¼ amp. each, except the one for the power tube MU-6 in the last a.f. tube socket; this ballast must be of the ½-amp. type. The MU-6 tube used has a 6-volt filament, and, while the ballast indicated is not necessary for this tube, it is installed so that other types of tubes may be substituted, if desired, in the second a.f. stage. Three MU-20 tubes must be used in the resistance-coupled unit; therefore the 6-volt filament supply line is taken directly to this unit.

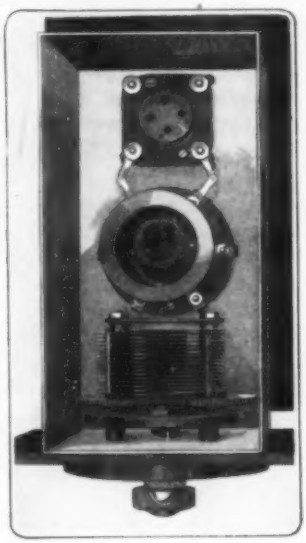
There are a few slight changes necessary in the resistance-coupled unit to facilitate wiring under the subpanel, and these changes must be made before this unit is mounted in its position. Six small C-battery posts will be noted on the upper front edge of the unit; these posts are connected together on the underside of the unit with short metal strips. Remove these strips and replace the nuts as you found them; soldering lugs are then placed under the three binding posts located on the top of the unit at the end of each resistor marked 1.M and connected together with a short length of busbar wire as shown in the wiring diagram. The remaining three C-battery posts nearest each tube have no external connection on this side of the unit.

Referring to the subpanel layout, note the holes drilled in the subpanel and marked respectively P, B, A-negative, A-positive and B-positive; these holes are directly below the corresponding posts of the unit when it is in position. Carefully remove the corresponding binding posts on the unit and replace them with five 1½-in. brass machine screws; leaving the connecting strips on the underside of the unit just as they were and screwing up hexagon brass nuts to hold the strips firmly in place. Posts B-negative and "output" B are not disturbed, and no external connection is taken to them; these posts are marked "open" in the wiring diagram. The "output" P-post is not disturbed and carries the only external connection on this side of the unit, namely the output of the unit to the P-post of the filter. The unit is now ready for mounting on the subpanel and before mounting it see that all terminals are tight; the long screws at the four corners hold the unit in position. Additional brass nuts are placed on the long screws that replaced the binding posts and are now protruding through to the underside of the subpanel; soldering lugs

MATERIAL LIST

1 front panel, 3-16 by 7 by 30 in.
1 subpanel, 3-16 by 10 by 29 in.
2 strips bakelite, 3-16 by ½ by 5 in.
1 strip bakelite, 3-16 by ½ by 2 in.
1 Daven 3-stage super-amplifier unit, type 3-R.
3 Daven ¼-amp. ballasts, complete with No. 50 mountings.
1 Daven ½-amp. ballast, with No. 50 mounting.
3 Daven MU-20 tubes.
1 Daven MU-6 power tube.
4 201-A tubes.
1 S-M plug-in-coupler unit, type 110-A.
1 S-M universal socket, type 515.
1 S-M tuned air-core filter, type 211 (available for any frequency between 40 and 50 kilocycles) any of which may be used.
2 S-M a.f. transformers, type 220.
1 S-M output transformer, type 221.
1 S-M aluminum shield, type 631, for oscillator unit.
2 Remler capacity units, .0005 mfd., type 631.
1 Jewell or Hoyt A and B voltmeter, double range, 0-7.5 and 0-150 volts.
5 standard spring-suspended sockets, Benjamin or similar type.
3 cord-tip plugs and jacks.
2 Benjamin subpanel brackets.
1 Samson r.f. choke coil.
2 National velvet-vernier dials, type B, dual range.
1 midget condenser, Chelton or S-M, low-loss type.
1 three-tap, loop aerial, box type preferred.
3 4½-volt C-batteries, large, tapped type.
1 1½-volt single cell, C-battery, large type.
3 45-volt B-battery units, heavy-duty type.
1 gridleak, 2 meg.
1 gridleak, .1 meg., with mounting clips.
1 400-ohm potentiometer, Frost, Yaxley, Centralab, or similar type.
1 20-ohm rheostat.
1 jack, open-circuit type.
1 push-pull filament switch.
11 binding posts, with engraved tops.
3 Sangamo fixed condensers, .0025 mfd.
1 Sangamo fixed condenser, .0005 mfd., with gridleak clips.
1 Sangamo fixed condenser, .006 mfd.
1 by-pass condenser, ½ mfd., Sangamo, Dubilier or Tobe-Deutschmann.
8 doz. soldering lugs, long, round-hole type.
10 2-ft. lengths, round, tinned-copper busbar wire.
4 lengths black spaghetti tubing.
2 ft. stranded, flexible, rubber-covered fixture wire.
12 6-32 brass machine screws, 1½ in. long, round head.
18 6-32 brass machine screws, 1 in. long, round head.
30 6-32 brass machine screws, ½ in. long, round head.
7 6-32 brass machine screws, ½ in. long, round head, nickelplated.
20-in. strip brass, 1-16 by ½ in., for brackets.





Above, Panel Template and Subpanel Layout; Below, Bracket Details and Photo of Oscillator Unit with Top of Can Removed

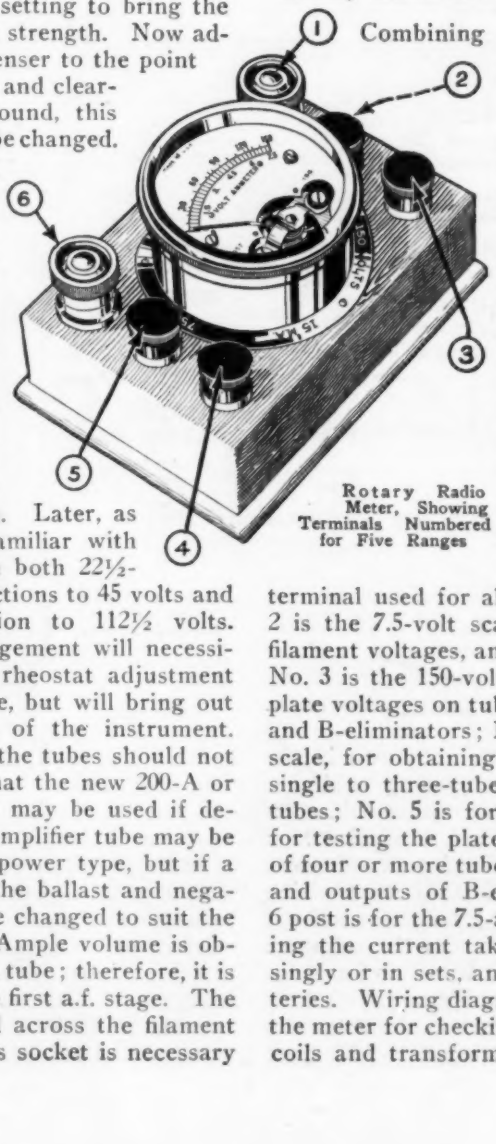
are then fastened to them with additional brass nuts. Note that the brass center bracket carries the common A and B-negative line, the A-negative line being completed through the push-pull filament switch.

Wire the circuit just as shown in the large wiring diagram, placing soldering lugs under all terminals; never solder directly to any instrument. Soldering lugs should be fastened to the fixed condensers by means of two short brass machine screws. Use a good grade of spaghetti tubing over any leads under the subpanel that would be likely to touch and cause a short. After the wiring is completed, connect all the batteries just as shown in the wiring diagram and turn on the filament switch; place one tube successively in each socket to test out the filament circuit; if all right, all tubes may then be placed in their respective sockets. The loop used should be of the three-tap box type and can be placed anywhere convenient to the set, keeping the leads reasonably short; the center loop lead is plugged into the center loop jack, the outside leads in the outside jacks. To test out the set, plug in the coupler coil

and place the rotor of the coupler at an angle of about 45°, replacing the lid of the can firmly so that it will not vibrate; plug in the loud speaker and turn on the filament switch. Turn the rheostat well over to the right, and keep the potentiometer as far to the left as possible for the first test. Slight changes in the rheostat and potentiometer settings will be required but the approximate positions are as given. To pick up a station, slowly rotate the dials in step, never tuning them independently when locating a station. When the signal is heard at good volume, leave the oscillator dial as it is and readjust the wavelength dial a few points on either side of the oscillator setting to bring the signal in at maximum strength. Now adjust the midget condenser to the point that gives the loudest and clearest signals. Once found, this adjustment need not be changed. For these first tests, which should be made when local stations are on the air, it is well to keep the B-battery voltage to the plates of the oscillator and detector tubes on both 22½-volt posts, and the resistance - coupled unit on 90 volts just as shown on the large wiring diagram. Later, as you become more familiar with the instrument, raise both 22½-volt B-battery connections to 45 volts and the 90-volt connection to 112½ volts. This B-battery arrangement will necessitate a more critical rheostat adjustment on the oscillator tube, but will bring out the full possibilities of the instrument. The arrangement of the tubes should not be changed except that the new 200-A or 300-A detector tubes may be used if desired. The first a.f. amplifier tube may be either a 201-A or a power type, but if a power tube is used, the ballast and negative grid bias must be changed to suit the tube specifications. Ample volume is obtained with the 201-A tube; therefore, it is recommended for the first a.f. stage. The .1-M resistor, clipped across the filament and grid posts of this socket is necessary regardless of the type of tube to be used.

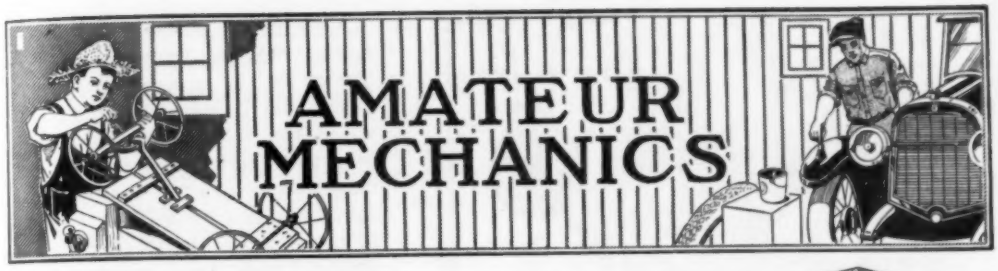
Popular Mechanics radio laboratory has made every effort to make this set as simple to build as possible; all details have been carefully checked, and a set of enlarged blueprints of the wiring diagram, schematic diagram, full-size drilling templates, as well as additional photos of the subpanel layout and under-subpanel wiring have been prepared. The complete set may be obtained from Popular Mechanics Radio department, 200 E. Ontario st., Chicago, Ill., for 75 cents. Specify blueprint No. 114.

Rotary Radio Meter Has Five Ranges



Rotary Radio Meter, Showing Terminals Numbered for Five Ranges

Combining five ranges, a new radio meter of rotary design has appeared on the market. It can be used for all testing on receivers, tubes, batteries, battery chargers and battery eliminators. The meter is mounted on a mahogany block, and is turned by a knurled rim to the five different positions, registering with each of the binding posts through a series of segments within the base block. The No. 1 post is the positive terminal used for all measurements; No. 2 is the 7.5-volt scale, for testing tubes, filament voltages, and A-battery voltages; No. 3 is the 150-volt scale, for measuring plate voltages on tubes, and of B-batteries and B-eliminators; No. 4 is the 15 milamp. scale, for obtaining the plate current on single to three-tube sets, and for testing tubes; No. 5 is for the 75-milamp. scale for testing the plate current of large sets of four or more tubes or power amplifiers, and outputs of B-eliminators. The No. 6 post is for the 7.5-amp. scale for measuring the current taken by tube filaments, singly or in sets, and for charging A-batteries. Wiring diagrams are supplied with the meter for checking battery eliminators, coils and transformers.



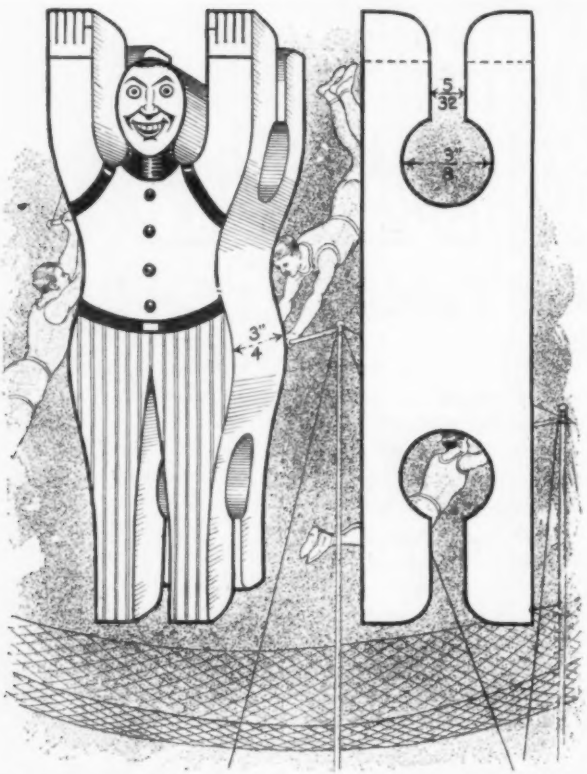
Making a "Tumbling Teddy"

By E. R. HAAN

THE toy described in this article is very simple to make, but will provide endless amusement for the youngsters. No special tools, other than those to be found around the average home, are needed for its construction; a scroll or coping saw is useful for cutting out the figure of "Teddy" himself, but, in the absence of this tool, the figure can quite easily be cut with a knife, if a little care is used in the operation.

The ladder is the first thing to make. This is formed from two lengths of ⅜ by ⅜-in. wood, 24 in. long, with eight rungs of ⅛ by 11/32-in. stuff, each 2¾ in. long, spaced exactly 2⅞ in. apart. The rungs are fastened to the sides of the ladder with common pins and glue, leaving one off at one end temporarily. On each end of the ladder is fastened a base, consisting of a block of wood, 4 in. square and 1 in. thick. As will be noted, the end of the ladder sides are set in inclined slots cut in the base blocks, glued, and fastened with round-headed brass screws. When joined to the bases, the ladder is not exactly vertical, but inclines 1 in. for every 10 in. of its length. The ladder can be made in any length desired; there is no need to stick to the 24-in. size of the original, but, in case it is made longer, the bases must be made longer also, so as to keep the toy stable. For a very long ladder, it would be best to fit one base and leave the upper end of the ladder open, but this means that the figure must be lifted from the bottom to the top every time

Here Is "Tumbling Teddy," an Acrobatic Clown That Will Amuse the Youngsters for Hours at a Time



Details of the Figure of Teddy; the Holes and the Slots Must Be Exactly in the Center of the Clown

it tumbles down, while with a base at each end the whole ladder is simply reversed, and Teddy then tumbles to the other end of the ladder.

The figure of Teddy is 3⅛ in. long, from the tip of the upraised hands to the bottom of the "feet." The figure is cut out of ¾ in. stock, preferably with a scrollsaw, as mentioned previously. The exact width of the figure is not so important, but in the original the width at the widest part, on a line across the shoulders, is 1 in., at the waist ⅝ in. and the hips ⅞ in. Exactly in the center of the thickness of the figure, and ¾ in. from the ends, two ⅜-in. holes are drilled through, and 5/32-in. slots cut from these to the ends. It is important that the holes and slots be exactly in the center of the figure, else Teddy will not perform properly. The inner edges of the slots are rounded off as indicated in the detail drawing. When finished, the figure is placed on the ladder at the place where the rung was left off, and this rung then pinned and glued in.

Now, if the ladder is placed upright, with the figure at the top, Teddy will gracefully tumble down the ladder to the bottom, when the whole toy is reversed and the operation repeated. It may sometimes be found necessary to trim a little from the sides of the slots so that the figure can swing freely, and tumble down without a stop from top to bottom, but a little experiment will soon put it in first-class shape. The toy, of course, may be decorated in any manner desired.

Making Bicycle Tires Unleakable

Any bicycle tire that has a few small holes in it and is not worn down much, can be repaired easily so that it can be used until the rubber wears through. The tire is taken from the wheel and a small slit, about 6 or 8 in. long, is cut in it in the inside edge, as indicated. Next a supply of corks, a little smaller than the diameter of the tire, is procured. Corks cost almost nothing, so enough of them can be bought for a few cents. The slit is pulled open and the corks are inserted into the tire, care being taken to keep them straight. They can be pushed entirely around the tire with a piece of rubber hose so as to make them fit tight. After the tire is completely filled with corks, the section of the tire where the slit was cut can be tightly taped to keep the tire intact. The tire is then replaced and glued with rubber cement. This repair will be found very good.—Wilson G. Walters, Rochester, N. Y.

Compressed Air Cleaning Away Mush Ice

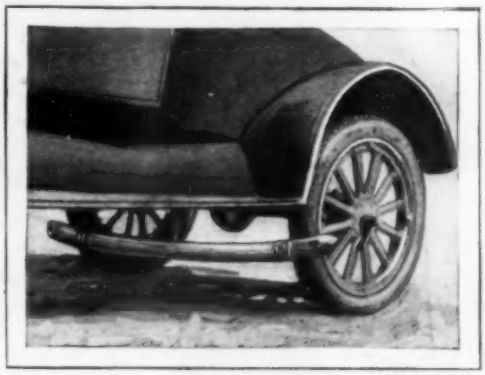
The successful winter operation of a hydroelectric plant was menaced by the entrance of mush ice into the penstock. This plant incurred considerable expense by the building of a series of screens designed to keep the ice out. But the ice continued to form and choked the screens. These were discarded in favor of a steam line to melt the ice before it could enter. This method also proved unsatisfactory. A visitor at the plant suggested the use of compressed air. A very small compressor was installed and the air piped to a point below the intake where, when released, the air would bubble up to the surface of the water. The thousands of little bubbles kept the entering water in such turmoil that ice could not form over it.—Sherwood J. Gee, Montpelier, Idaho.

Sharpening the Razor

Take a clean, bright piece of ½-in. lead pipe and rub it over the razor strop a few times. Then strop your razor, and you will find how quickly it will be sharpened. I have been doing this for 15 years and have never found it necessary to hone my razor.—H. A. Barwick, Montreal, Can.

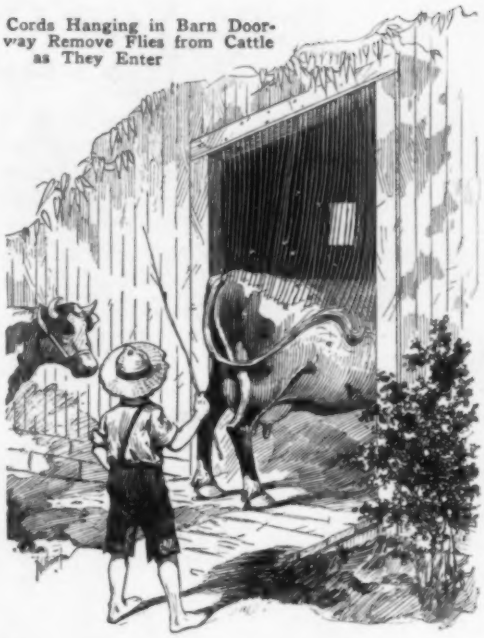
Fence Post Pulls Auto Out of Mud Hole

Due to the differential action of the rear wheels of an automobile it is often a difficult job to get out of a mud hole, as most drivers have experienced. However, by fastening a fence post, or any post of suitable size, to the rear wheels, as illustrated, it is a comparatively easy job to get out of the mud. The post should be tied to the wheels under the driveshaft and removed when it reaches the back of the fenders.—Art. Hellberg, McGregor, Iowa.



Get Your Car Out of a Mud Hole with the Aid of a Fence Post

Cords Hanging in Barn Doorway Remove Flies from Cattle as They Enter



Barn-Door Fly Chaser

Observing that most of the flies that troubled his cows at milking time were carried into the barn from the pastures by the animals themselves, a Wisconsin farmer made the fly chaser shown in the illustration, and reduced the annoyance to a great extent. Across the door from the yard to the barn a bar was placed at a height of 7 ft. and from this was suspended a curtain of twine strands, which hung to within 2½ ft. of the ground. As the cows entered the barn through this door, in single file, the curtain brushed across their backs and sides and dislodged the flies, allowing the animals to enter the barn practically free from them. By keeping the interior of the barn darkened the milking then could proceed without much trouble.

¶Mirrors and picture glasses should be cleaned with a pad of tissue paper sprinkled with methylated spirits.

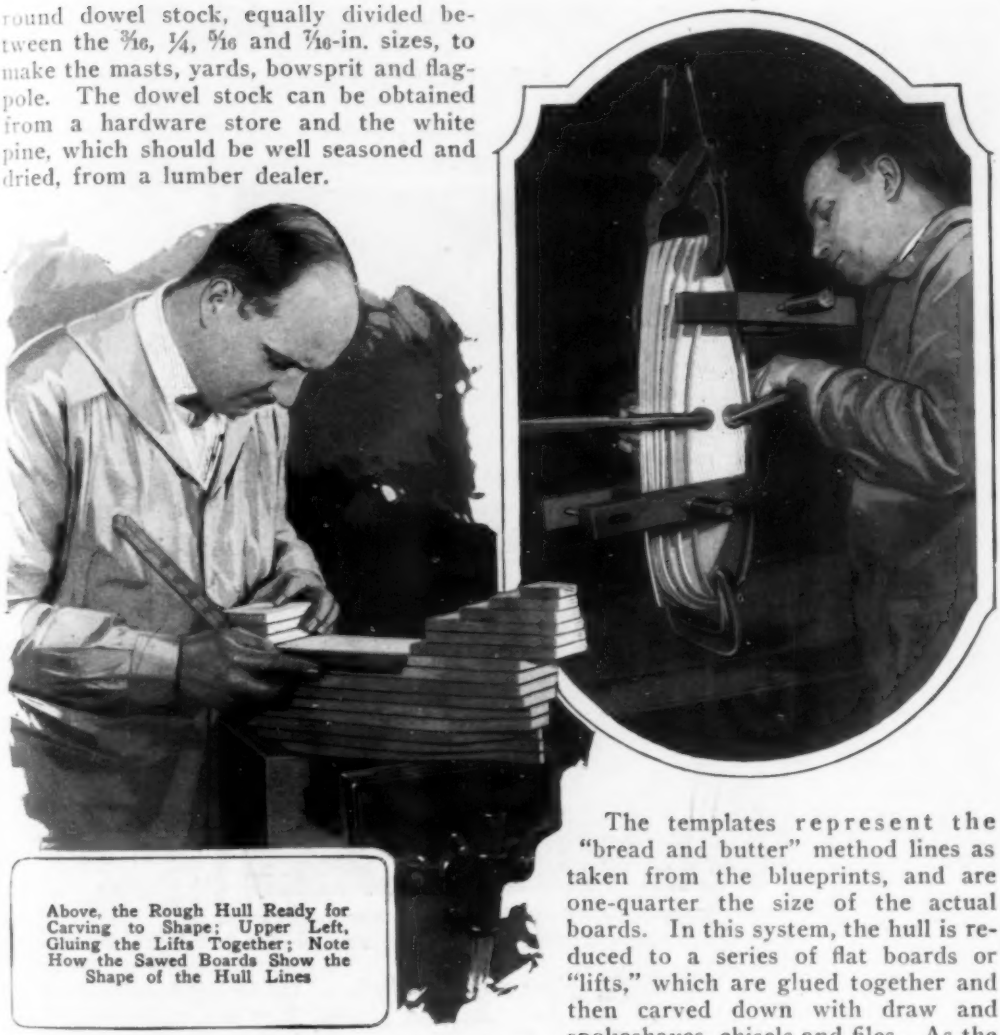
Build Your Own Ship Model

By J. EARLE MILLER

BUILDING one of the ship models which have attained such favor for interior decoration is a simple task, once the secret of the carving of the hull has been mastered. This job has scared many prospective model builders, but by the "bread and butter" method used by professional model makers the hull is, in fact, the easiest and simplest part to make.

This is the story of the building of a model of Hendrick Hudson's "Half Moon," one of four model ships recently constructed in the Popular Mechanics experimental shop. While no authentic plans of the actual "Half Moon" exist, this model represents what the ship must have been like, according to contemporary accounts and plans.

To start with, the builder will need four 2 ft. lengths of 7/16-in. net white pine, 10 in. wide and free from knots; a cigar box or two for thinner wood; a dozen lengths of

round dowel stock, equally divided between the 3/16, 1/4, 5/16 and 7/16-in. sizes, to make the masts, yards, bowsprit and flagpole. The dowel stock can be obtained from a hardware store and the white pine, which should be well seasoned and dried, from a lumber dealer.

Above, the Rough Hull Ready for Carving to Shape; Upper Left, Gluing the Lifts Together; Note How the Sawed Boards Show the Shape of the Hull Lines

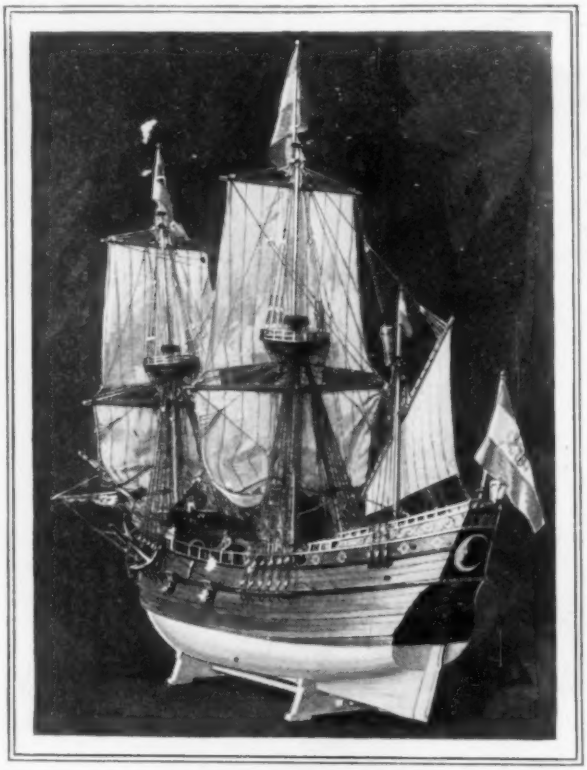
The tools needed include a coping saw, a drawshave and spokeshave, flat chisels and gouges, several flat, half-round and round files, a wood-carver's knife, or, in its stead, a strong, sharp jackknife, a glue-pot and supply of a good grade of glue, two or three large clamps and a half dozen of the small metal clamps sold in the dime stores.

Blueprints for this, and a wide range of other ships, are sold at prices ranging from $2.50 to $10 a set, depending upon their completeness. A full set of five prints purchased from a model designer for this ship costs $10, but the ship can be built without the use of prints by laying out the hull from the templates given.

The templates represent the "bread and butter" method lines as taken from the blueprints, and are one-quarter the size of the actual boards. In this system, the hull is reduced to a series of flat boards or "lifts," which are glued together and then carved down with draw and spokeshaves, chisels and files. As the inner edge, where each two lifts meet, represents the hull line at that point, it is only necessary to carve off the projecting corners. The carving of this hull was completed in less than an hour.

The hull templates, as given, were laid out for lifts 7/16 in. thick, which happened to be the size on hand. Take a large sheet of drawing or heavy wrapping paper and lay it out in 1-in. squares. Using one of the horizontal lines as a center, lay off the full-size half-template according to the squares given for line No. 1. Then fold the paper along the center line and cut both thicknesses at the same time. Unfold, and you have the full template for the first plank below the finished deck. Follow

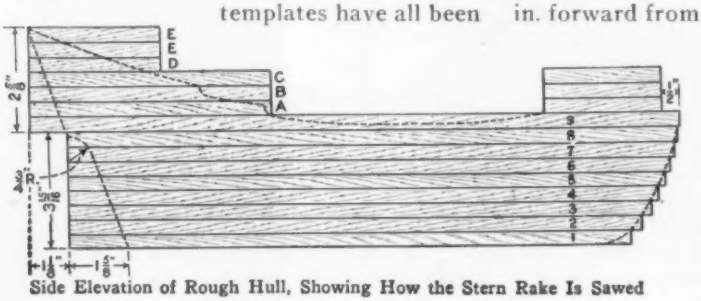
the same process for the other eight lifts in the hull, and for the shorter pieces of the poop and forecastle (fo'c'sle). The rounded ends of the templates are the bow ends. The templates are then laid out on the pine boards, marked, and are then ready for sawing. The bow or stern ends of each piece should be indicated, and the center marks at bow and stern transferred from the templates to the wood. The lifts are then sawed out with the coping saw, and are ready for gluing, after the center lines have been marked down one face and both ends.



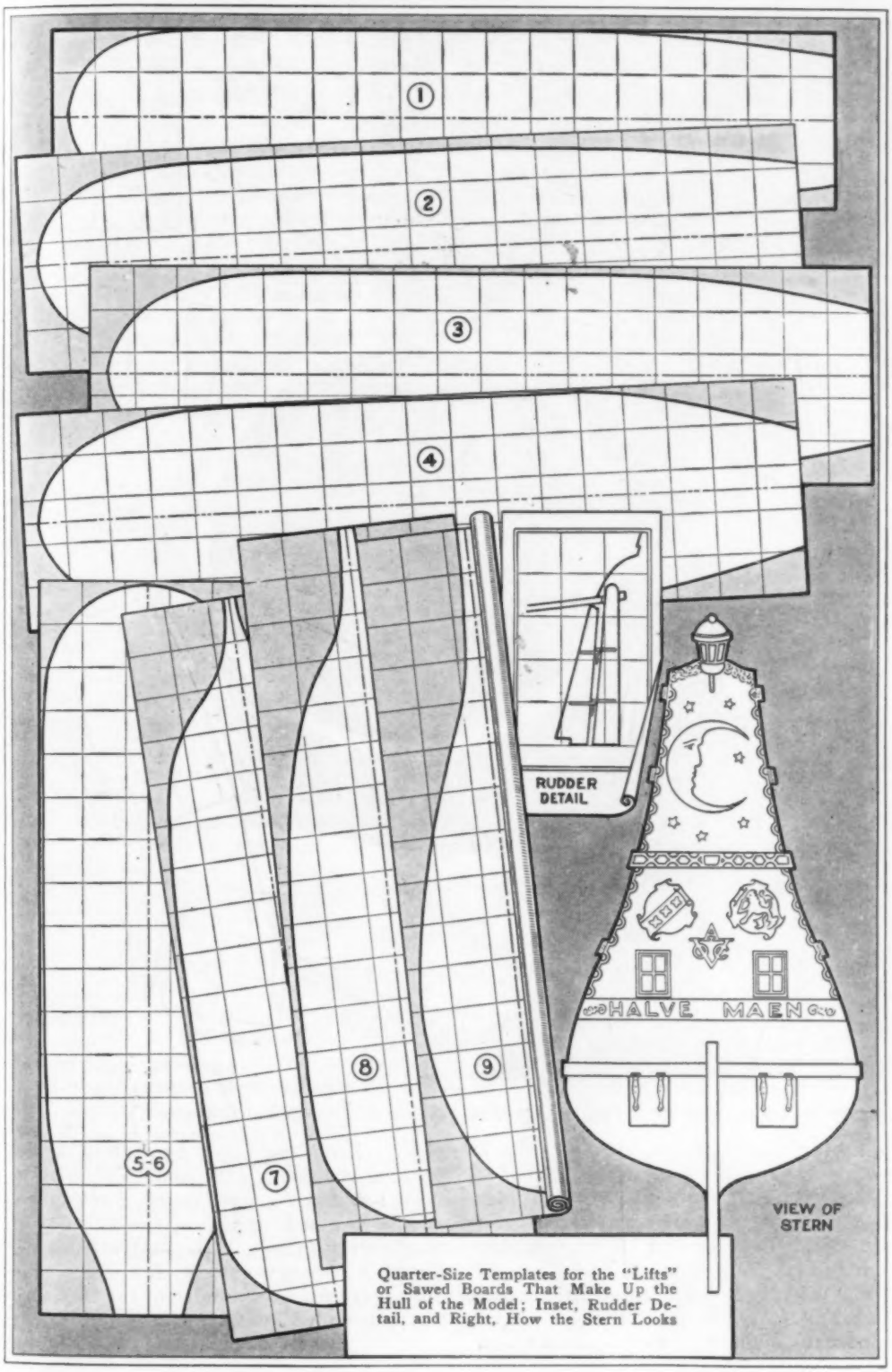
View of the Completed "Half Moon" Model, Fitted with Sails

Start with lift No. 1, coat it with glue on the side bearing the center mark, and coat the unmarked side of lift No. 2; place the two glued surfaces together and line them up by the center marks. As No. 1 is the first lift under the deck line, you are building the hull from the deck down to the keel, so that the center lines will be face up, and as the lifts get smaller toward the keel, each succeeding one can be lined up by the end marks. At the stern the templates have all been continued to the same length, and the ends are lined up vertically as the gluing proceeds, while the bow ends get progressively shorter, simplifying the later carving of the stem. When plank 9 has been glued in place, clamp the entire hull tight and set it aside for twenty-four hours. While it is setting, the laminations of the poop and quarterdeck and the forecastle can be glued together in the same way and placed in clamps or a vise.

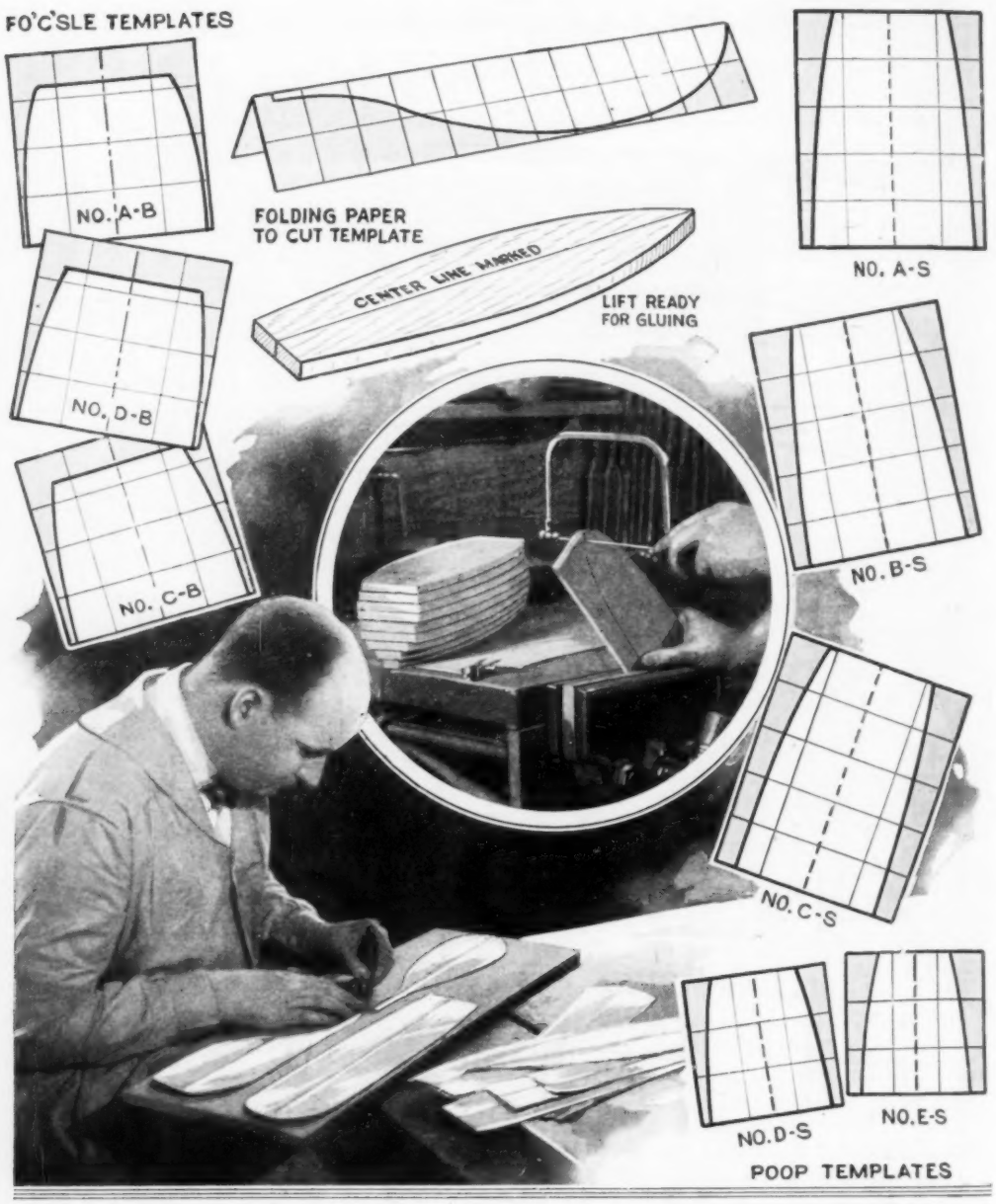
After the glue has set, the forecastle and stern superstructures are glued to the main hull and held in place with the large clamps. Like the hull parts, the pieces of the poop and quarterdeck are cut to line up at the stern, and, in gluing, they are centered in the same way as the hull parts. In assembling the stern superstructure to the hull the upper works project over the stern 1⅛ in. to take care of the extreme rake of the stern, which is sawed out later. After the stern sections are glued and clamped in place a line is drawn across the deck 8½ in. forward from the front end of the lower lamination of the quarterdeck, and the forecastle glued on, with its rear edge on this line. The completely assembled hull and superstructure, ready to start carving, is shown in the photograph on page 669. The first step is to saw



Side Elevation of Rough Hull, Showing How the Stern Rake Is Sawed



Quarter-Size Templates for the "Lifts" or Sawed Boards That Make Up the Hull of the Model; Inset, Rudder Detail, and Right, How the Stern Looks



Details of Making and Using Templates, Marking Out Lifts from Templates, and Sawing Them Out

the rake of the stern. Draw a line down the side from the extreme rear of the topmost plank in the poopdeck, to the point where the superstructure meets the main hull. Next mark a point 1⅞ in. from the stern end on the keel plank, and a second point 3 1/16 in. up from the bottom of the keel plank and ¾ in. in from the stern, and connect this point with the one on the keel plank. From the upper point draw a ¾-in. arc, and then, with hand and coping saws, saw out the stern rake. Next shave off the last inch or two of the hull down to the stern lines. With that much completed, it is easy to shave off the projecting edges of the remainder of the hull until the rounded lines are completed.

(To Be Continued)

Mounted Photographs Set on Imitation Rock Base

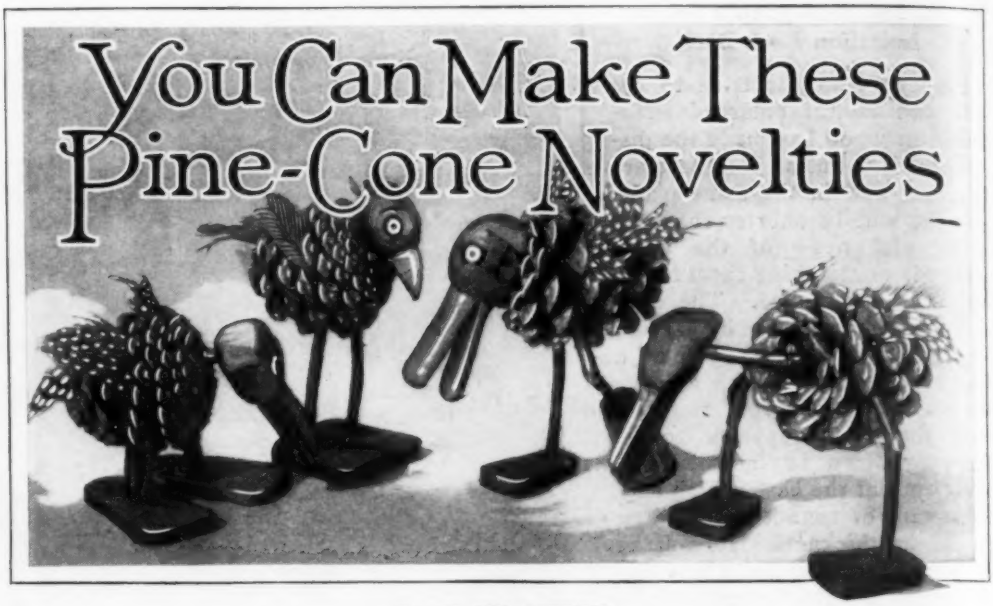
Anyone who has tried to cut out and mount enlarged snapshots on wood has made the discovery that, unless both feet are together and in the same plane, one leg will be shorter than the other and none of the usual methods of attaching them to the base can be applied. The difficulty can be overcome by carving an imitation bowlder from a block of soft pine, with a ledge on which the rear foot rests, so that the figure appears to be stepping down from the rock. First cut out the base, which may be square or round, about ⅝ or ¾ in. in thickness. If a lathe is available, an attractive base can be turned in a few moments. Lay a piece of 1-in. soft pine on the base, with its front edge ¾ in. back from the edge of the base block, and, with a pencil, lay out an irregular-shaped piece, slightly smaller than the base block and forming about three-fourths of a circle. Cut it out with a coping saw, and then, holding the mounted photo against the straight surface at the front of the block, mark the outlines of the feet. With a small gouge or knife cut recesses for the feet to a depth of about ¼ in., sloping them slightly back at the top so that when the figure is glued in place, it will lean backward about five degrees. Take a piece of wood about 1 in. wide, nail the block to it and clamp in a vise. This holds the block firmly and leaves it free for carving. Use small chisels or gouges to cut away the material, sloping the imitation rock down to the edges, and leaving as many gouge marks as possible, as, the rougher the rock is, the better it will appear when finished. Nail or glue the completed carving to the base, and glue the figure in place. A good finish can be obtained by lacquering the edges of the base black and giving the rock and visible portions of the top surface of the base a heavy coat of bronze. After the bronze dries, paint it over with a green vernis-martin lacquer, and before this has quite set, wipe off most of the green with a rag, leaving it showing in the cracks and recesses. The back and edges of the board on which the photo is mounted can be bronzed and treated in the same way.—J. Earle Miller, Chicago, Ill.

Imitation Rock Base for Mounted Photos Solves the Problem of Mounting Them

Keeping Shoes Tied

Children often run around with loose shoe strings, which looks untidy and is also a source of danger. A good method of making the knot stay tied is shown in the photo. Both ends are run through the same top eye and the lace is then tied in the usual way. It will be found that this knot will not loosen. Of course, the string should not be so long that the loose ends will reach the ground.

You Can Make These Pine-Cone Novelties



By F. W. WEST

ATTRACTIVE or grotesque birds and other novelties can easily be made from pine cones by anyone possessing a little skill and ingenuity. Besides the cones, all the material needed is some sticks, twigs, feathers and paint. No particular sizes are given, as they must depend on the size of the cones and upon the effect one wishes to obtain.

A general idea of the birds may be obtained from the headpiece, and Figs. 5, 6, 7, 8, 9 and 10, which show the details. The heads are most easily made from small forked pieces, which should be at least 1 in. in diameter after the bark is removed. The painting may be done with oil paint, water colors or lacquer. The latter is easily applied and dries quickly. Two brushes are needed, one a No. 1 camel's-hair brush for the eyes and for striping, and a No. 3 brush for the other work. The eyes should be painted first, preferably black. Fill in with green around them, as indicated in Fig. 8. Next paint the top of the head, using red. The light part of the beak is yellow. Then, with the small brush, make a black stripe down the sides of the beak to divide the lower and upper part. The appearance can be improved by separating each color with a stripe of black. White pine or other soft wood is most suitable for the legs and feet.

To assemble the birds, attach the legs to the cone first. Take two small twigs of any length and size desired, shave one end of each down thin (Fig. 9) and apply a little glue. Then insert the legs between the scales near the stem end and, after the glue has set, trim the legs to the desired length, shaving off the lower end to fit in holes drilled in the feet, which should be about ¼ in. thick, and attach with glue. To fasten the head, drill a small hole in the stem end of the cone, shave the end of the neck to fit and attach it with glue. Finally glue a small feather to each side of the cone to represent wings, and one or two feathers in the end for a tail, and the bird is complete.

The turtle (Figs. 1 to 4) should be made from a well-formed cone with the scales at the stem end intact. This end is cut off and forms the back shell. Drill a small hole through the center where the stem was removed. The under shell, Fig. 3, is cut from ¼-in. wood, just large enough so that the back covers it. The hole in the center is the same size as the hole in the back. Paint the beak and the eyes olive and black, respectively, and the other parts of the head and neck to match the natural color of the shell. The assembling is easy. The legs and tail are scales taken from another cone and are attached with

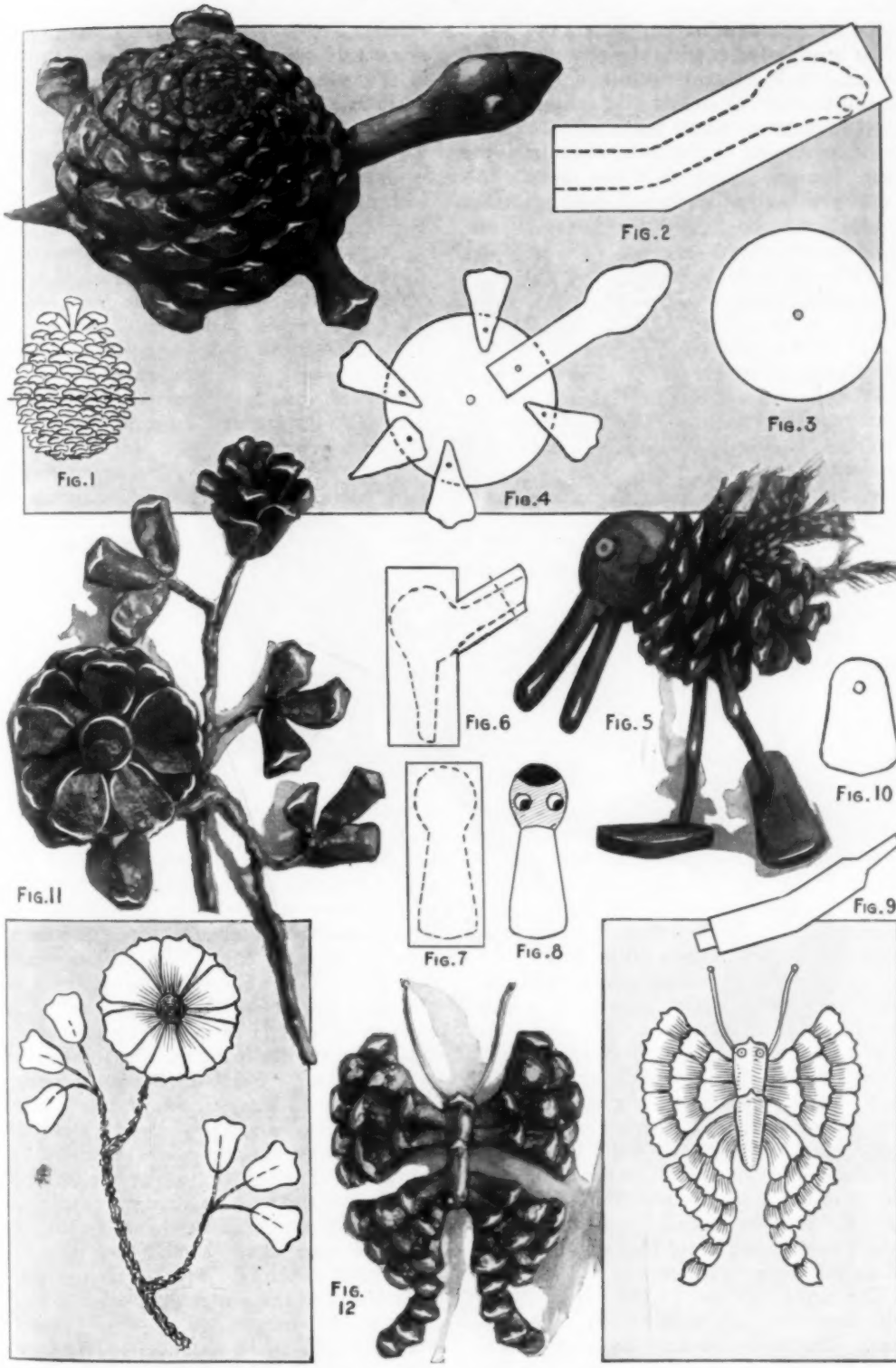


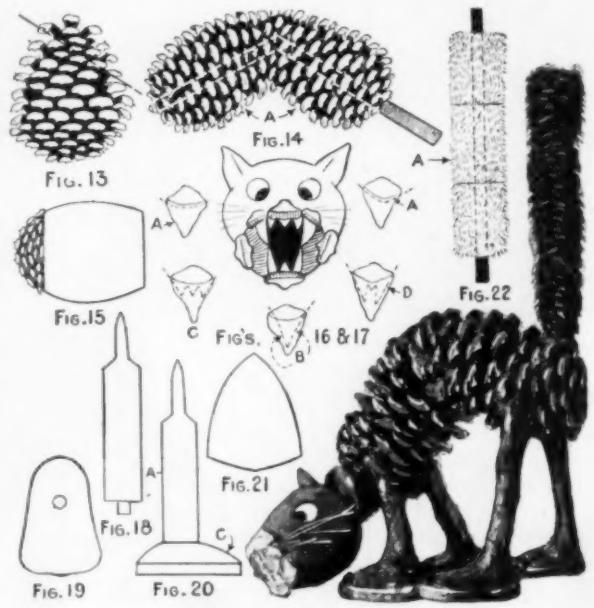
FIG. 1
FIG. 2
FIG. 3
FIG. 4
FIG. 5
FIG. 6
FIG. 7
FIG. 8
FIG. 9
FIG. 10
FIG. 11
FIG. 12

glue and a small brad or pin, as indicated. The head is fastened in the same way. To joint the back and bottom shell, use a small wooden dowel or pin, fitting tightly in the holes in these parts. Fasten with glue, squeezing or clamping them until the glue has set. Then trim the dowel flush with the bottom and back, and paint the ends the same color as the head. This completes the turtle.

Artificial flowers made from cone parts are shown in Fig. 11. To make them, cut the cones in two pieces of about equal length. For larger flowers remove a few of the foremost scales, leaving bare a portion of the core of the cone. Shape this to resemble the center of a flower, and drill a small hole to attach the stem. Smaller flowers are made similarly from the bare end of the core, drilled for the stem, which is made from small wire, preferably pipe-stem cleaners. The leaves are made of detached scales and are glued on.

For the butterfly (Fig. 12), trace the design on durable paper, attach with glue two or more scales for the body, and make the wings with scales overlapping like shingles on a roof, as indicated. Paint to suit yourself, and after the paint is dry, tear or cut away the surplus paper. The underside of the wings should be covered with silk or crepe paper, attached with glue that will not stain the material. The tendrils and legs are made of pipe-stem cleaners. Flowers and butterflies may be painted to suit your own fancy.

The cat (Figs. 13 to 20) requires two well-formed cones with all the scales intact. The cones should be equal in diameter, but one slightly longer than the other. The former makes the forepart of the cat's body. Cut both cones as shown in Fig. 13, and drill holes through the parts in the center to receive a piece of insulated wire with the webbing removed. To join the parts of the body, bend the wire as required to give the humped effect, apply glue to this and to the cut-off ends of the cones, run the wire through the cones and hold them together with a rubber band or piece of twine until the glue has set. If you want a longer body, two more cones may be cut off in the same way as the turtle shell and attached one to each end of the body, gluing in additional scales where needed. For the head, select a small cone, cut off the three or four foremost scales and drill a hole in the stem end to receive the protruding end of the wire. Fill and cover the entire open part of the cone with plaster of paris (preferred), furnace cement or putty, and form a flat surface for the mouth on the small end (Fig. 15). Smooth and shape the plastered surface with a putty knife or wooden paddle. If furnace cement is used, dip the putty knife or paddle frequently in cold water. Putty works very nicely if it is warmed before being applied. The head may also be made of wood if desired. The teeth and lips are made of scales, as indicated. The legs (Fig. 18) are formed from sticks and may be straight or slightly crooked, the hind legs a little longer than the fore legs. Match and trim to the length required. Shave the top end to fit between the scales on the body and cut a small, round tenon on the bottom end (Fig. 18) to fit the hole in the foot (Fig. 19). Use ¼-in. wood for the feet.



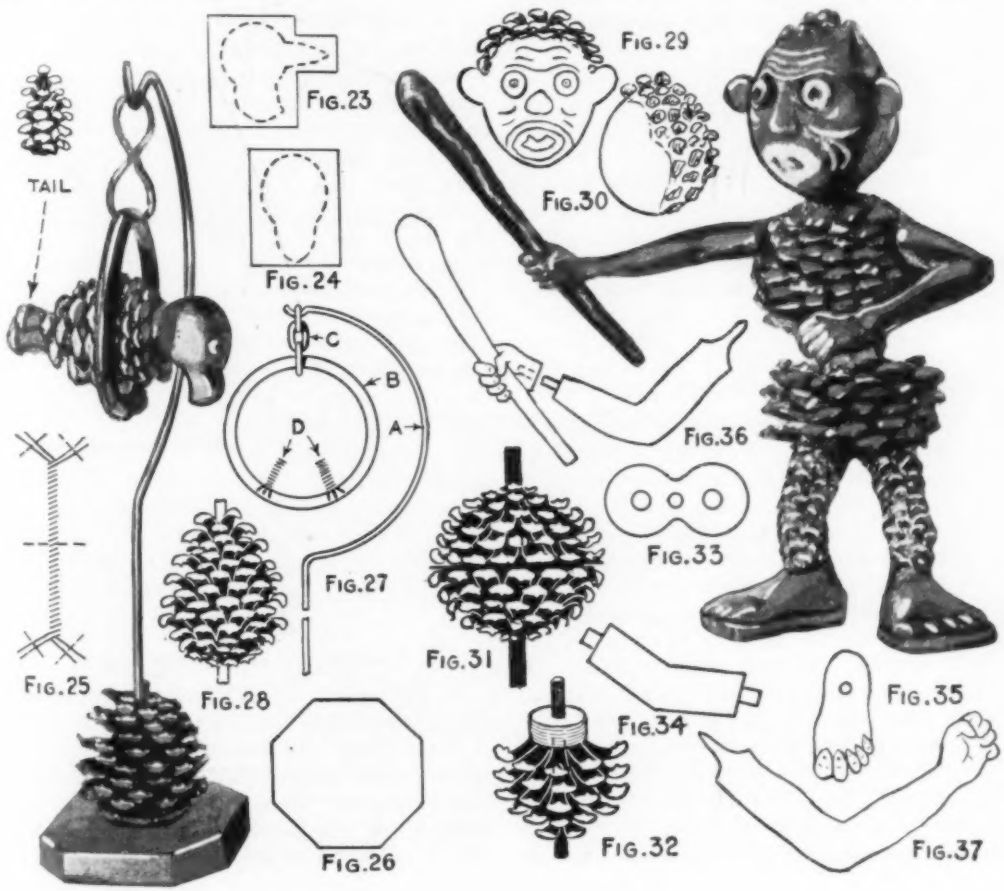
Build them up with plaster of paris, as at C. For the tail (Fig. 22) use the large ends of three or more cones with the scales cut down so that only a small portion remains to give a bristly effect.

Glue the ears and teeth in place. For the neck, use a short section of cone with the scales left on, but if any of them interfere with getting the legs in place, these may be split or removed. To attach the tail, cut the insulated wire flush with the top end, apply glue to the protruding wire on the other end and insert the tail as shown. The best way to paint the cat is to dip it or pour the paint over it, black being the most suitable color. After this is dry, paint the teeth white, the lips and mouth red, the eyes black and white, and the nose white. A scale or a small round-headed peg will serve for the latter. To attach the whiskers, made of bristles, drill holes with a needle, apply glue to the ends and insert them.

The parrot with its perch (Figs. 23 to 28) is a little more elaborate than the other birds, but after trying your hand on those, you will have small difficulty in making it and need but little description to guide you.

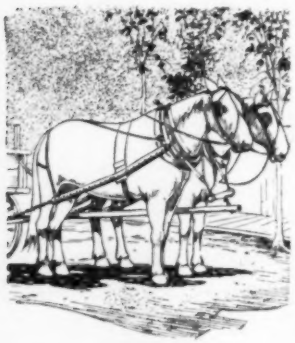
The feet and legs are made of pipe cleaners, four pieces being twisted together for the legs (Fig. 25) and the ends left loose to form the toes, cut as indicated by the dotted lines to make a pair. The base is cut from a ½-in. board about 4 in. in diameter. The upright is a 3/16-in. metal rod, 24 to 30 in. long, and bent to the shape shown. The ring should be at least 3½ in. in diameter. The link supporting the ring may be a piece of small chain, or a ribbon may be used. The wings and tail should be made of scales and are dipped in red enamel or lacquer. The assembly is readily understood from the drawings.

The savage (Figs. 29 to 37) is also a good figure to make. The eyes are painted



on, or tacks having large, flat heads may be used instead. The facial wrinkles may be cut or painted in. The upper part of the body is made from the stem ends of two cones, cut off and joined with wire or with a small, round stick. To make the lower part of the body, cut the small end out of a cone, and remove all but four tiers of the mid-section scales (Fig. 32). Drill a hole through the center to receive the long end of the wire protruding from the upper part of the body. The piece in Fig. 33, used to attach the legs to the body, is cut from thin wood and small enough to be entirely covered by the lower part of the body. The center hole in this piece receives the wire protruding from the lower part of the body, and the outer ones the legs. The latter (Fig. 34) have small tenons to fit in these holes and in holes in the feet, to which small scales are attached for toes. The arms and hands are whittled from small, crooked limbs. The club and the hand holding it are made in one piece. Each arm is made separately with a small tenon on the end to attach it to the hand. Assemble the parts with glue and paint them black, the eyes white, and black, the lips and teeth white, and the inner part of the mouth red.

Trace-Chain Cover Prevents Chafing



To guard against chafing of the horses' flanks, a western farmer took old bicycle tires, cut them in two and slipped the trace chain inside of them as shown in the drawing. This not only prevents pain, but hushes the noise of the chain as well.—Dale R. Van Horn, Walton, Nebr.

Remedy for Soot-Choked Stovepipes

Where there are several lengths of stovepipe extending from the stove to the chimney there is a tendency for the stove to choke up and allow the smoke to enter the room. This is especially true of stoves burning soft coal. It is not always convenient to remove the pipes, but the trouble must be remedied at once for it is dangerous to let the coal gas escape. A quick remedy that will work at least until it is possible to clean the pipes thoroughly, is to start the fire going at a good rate and, when it is burning brightly, throw in a handful of powdered sulphur. Allow this to burn for a few moments and then throw in a cupful of water which will cause considerable steam. Then close all the dampers; this will force the soot out of the pipe. Another method is to use paraffin or tallow candles on the coals instead of the sulphur, throwing the water on the coals after the wax has melted.

Method of Starting Nails

When a nail is to be driven at some point so high that it cannot be held conveniently for starting, one of the two methods illustrated may be used successfully. Either the nail is wedged between the claws of the hammer with the head resting firmly against the latter, as shown in the upper figure, or it can be held between the fingers, letting the head rest against the hammer handle as shown in the lower figure.—W. C. Ratcliffe, Tannersville, Va.

Connecting Auto Stop Light

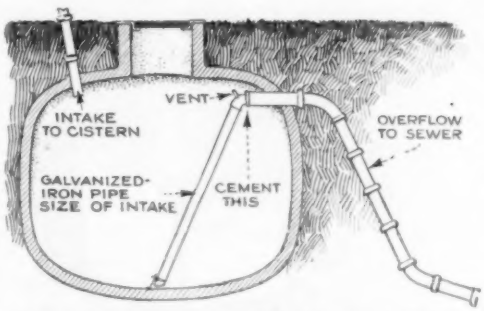
If the switch controlling the auto stop light sticks, the battery will run down in a short time. To avoid this, I connected mine to the ignition switch instead of to the ammeter. Thus it will not light except when the motor is running.—Preston J. Cheu, Millville, N. J.

Overcoming Troubles in Replacing Windshield Glass

Trouble is often experienced when replacing the lower glass in two-piece double ventilating windshields, which are used on many Ford cars. Glass of standard size is found too wide, and is so high, when in the frame, that the rubber weather strip cannot be used between the pieces of glass. The trouble usually originates from rain causing rust under the brass channel that holds the glass. The rust can be dug out with a sharp screwdriver after pulling out the brass channel. This must be done carefully, however, as the brass is easily bent out of shape. It can be removed by grasping the roll edge with a pair of pliers and pulling up. If the channel is sprung together so that the glass cannot enter, it can be straightened with a flat stick of wood of the same thickness as the glass, the end of which is pressed into the groove and pushed along in it. Another place for rust is in the groove on the underside of the frame, which fits over a strip on the dash. Rust here will hold up the whole windshield frame, but it can be easily scraped out.—E. T. Gunderson, Humboldt, Iowa.

Self-Cleaning Device for Cistern

To make a cistern self-cleaning, provide a length of conductor pipe and an elbow and connect them to the overflow pipe as shown in the drawing, taking care to cement the joint so that there will be no leak. When the water rises above the level of the overflow pipe it will be drained off, but, instead of the surface water running off, the water on the floor will be forced out and with it the dirt that has settled at the bottom. It takes only an hour to install the pipe, and it will keep the cistern water clean, provided, of course, there is enough rainfall to cause the cistern to overflow.—Joe Lauth, Pontiac, Ill.



How to Keep Your Cistern Clean Automatically with a Length of Conductor Pipe

Corner on Porch Provides Large Cage for Canaries and Gives Them More Freedom

Winter Bird House on Porch

Birds flying through the trees are one of the greatest delights of my garden and the one which I missed most keenly during the winter months. The sun porch was resortlike even in January with blossoming cyclamen, gorgeous cactus and ferns, and I determined to provide a winter resort for my canaries. I screened in the corner of the porch, provided swinging perches and a tin tray full of sand for a floor. The birds were then turned loose in it and showed their appreciation of their spacious home with warbles, chirps and trills. They require no more care than one bird. The front section of the screen can be raised like a window sash so that the sand may be changed and water and food provided. During the winter the radiator keeps the porch warm, and with all the windows open in the summer the canaries seem to almost believe they are outdoors.—Mrs. Ruth Laughlin Barker, Santa Fe, New Mex.

How to Make a Porch Lamp

Attractive Hand-Wrought Porch Light That Can Readily Be Made by the Home Mechanic

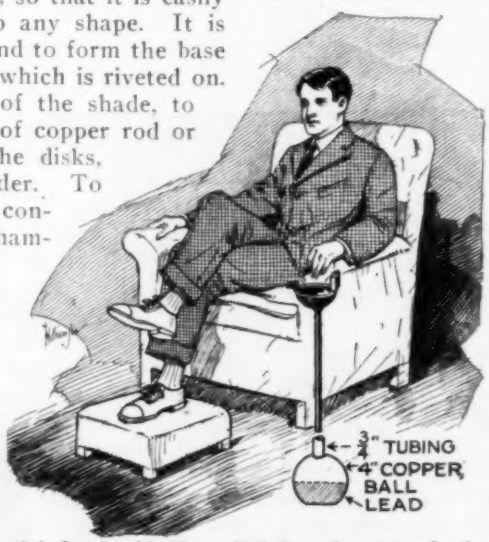
Novelty and usefulness are the features of the sheet-metal porch lamp shown in the illustration, which anyone handy with tools can easily make at a cost of less than $1.50. The glass shade consists of a colored bottle cut to form a cylinder. Use a file to nick the side of the bottle. Sheet copper will be found most convenient to work with. It is soft, so that it is easily bent or hammered to any shape. It is bent upward at one end to form the base for the shade holder, which is riveted on. A disk at each end of the shade, to close it, and lengths of copper rod or tubing, to connect the disks, form the shade holder. To make the upper disk convex use a ball-peen hammer on a concave wooden anvil. If desired, the whole surface can be hammered to give it a hand-wrought appearance, and this finish can be preserved by applying some transparent lacquer over it when completed. It should be noted that while the rods that hold the lower lamp disk and ring to the base are riveted, the rods connecting the upper and lower rings are simply inserted in holes so that they can be removed for cleaning the glass or renewal of the lamp.—G. A. Luers, Washington, D. C.

Starting Kink for Auto

In some of the earlier ignition systems, the starting current is so great that the coil cannot draw its full share. Also, when a modern engine is stiff or the battery is weak, a full voltage is not available for the coil. In nearly all of these systems there is a small resistance coil in series with the spark coil, the function of which is to heat up and cut down the current if the motor is stopped with the switch on. Shorting out part of the resistance coil will send a greater current through the coil. Connect the center of the resistance to either end through a convenient horn button. Solder should be used in tapping the coil. Use heavy, twisted lampcord, and a horn button with good contact points. Press the button only while the starter is operating.

Ash Stand That Cannot Upset

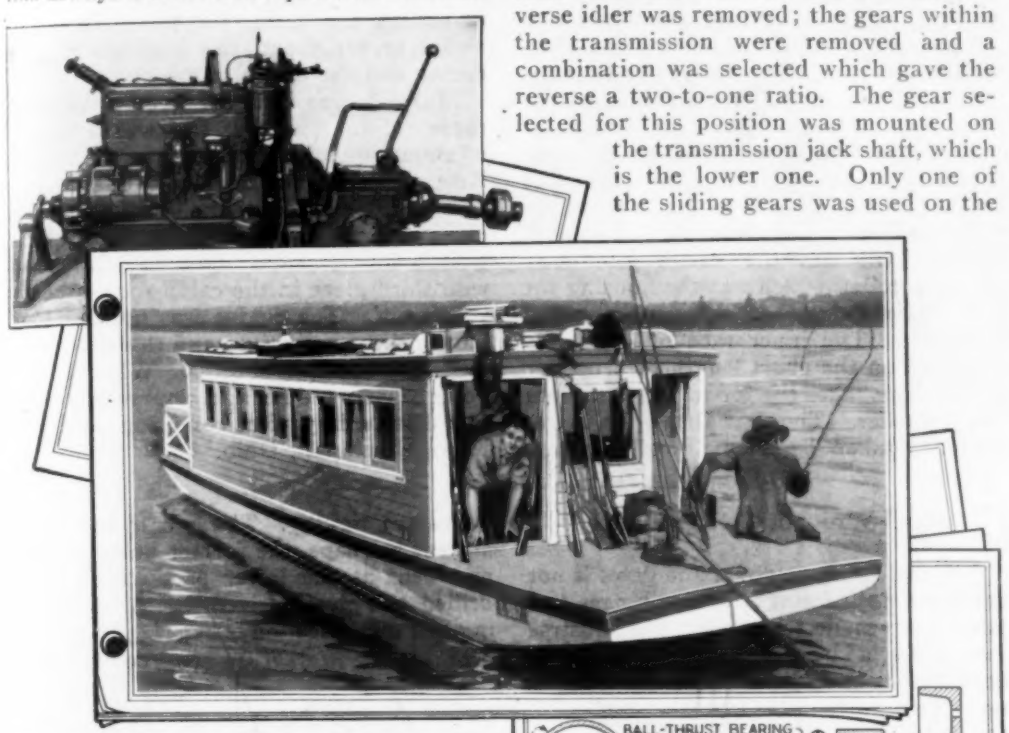
A smokers' ash tray, which can be tilted to any angle without upsetting, is shown in the illustration. The base consists of a 4-in. copper ball, which is half filled with lead. A slight depression is made in the bottom to make it stand steady. The column is a piece of ¾-in. brass tubing soldered to the ball and of any convenient length. To the top of the tube a medium-sized ash receiver is soldered. The entire stand can be nickel-plated or enameled and decorated with Egyptian characters. —L. C. Ferguson, Ontario, Calif.



Ash Stand, with Heavy Ball Base Containing Lead, Will Not Upset

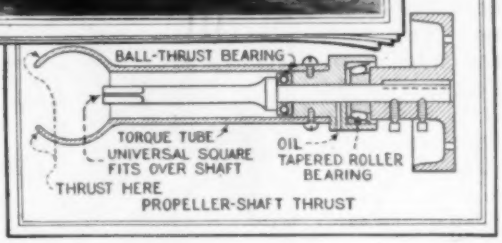
A Cabin Scow Driven by Auto Engine

THE conversion of automobile engines into power plants for marine purposes has always been a moot question. In this instance, such an installation was found entirely satisfactory. The engine first was overhauled and new bearings and piston rings were provided throughout.



Old Auto Engine Installed on Large Cabin Scow Furnishes Its Power and Gives a Speed of Eight Miles

For the cooling system, the old centrifugal pump was discarded and a ½-in. gear pump took its place. This had a two-way valve arrangement so that the bilge water could be pumped out. A small metal dash was built and mounted at the transmission to engine joint. On this dash the vacuum tank, oil gauge, ammeter, trouble light, ignition switch and controls were mounted. The starting switch with the automatic cut-out was mounted on the crankcase, where it is convenient to the foot. A length of 1½-in. iron pipe was used for the legs, and the mounting of the engine in the hull was thus greatly facilitated. The clutch and transmission assembly was used, the clutch being left intact but the transmission was changed. This originally had a four-to-one reverse ratio and this was too slow. The reverse idler was removed; the gears within the transmission were removed and a combination was selected which gave the reverse a two-to-one ratio. The gear selected for this position was mounted on the transmission jack shaft, which is the lower one. Only one of the sliding gears was used on the transmission shaft and this was arranged to be shifted into mesh with the little reverse gear. This gear with its mounting had to be provided with a new mounting on the side of the transmission case and this meant raising it and bringing it out a little to accommodate the gears it meshed with. A cast-iron block between the mounting and the case did the trick. Instead of four gears or speed changes in the transmission, there were now but two, direct forward and two-to-one in reverse.



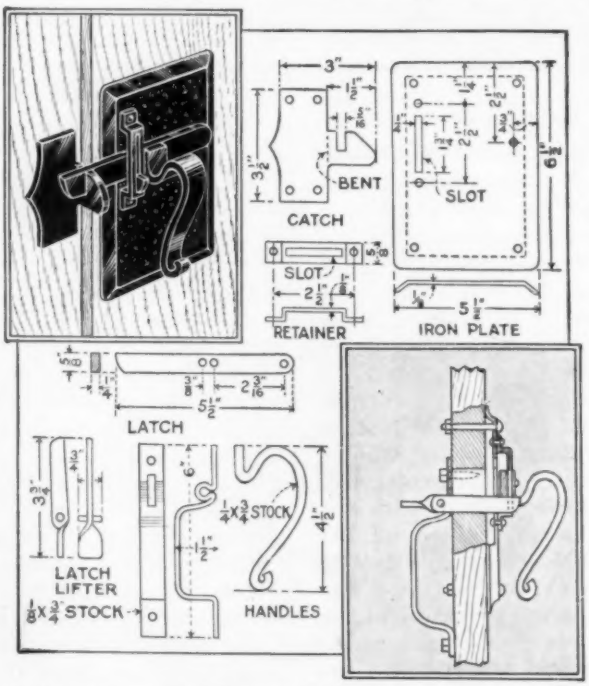
The clutch is shifted by means of the brake lever, which was bent and mounted so as to throw the clutch out when the operator lifts on the bent portion of the

handle. The drive of the boat is through the standard universal connection and a short length of propeller shaft, to the flange joint shown, and then on, through the propeller shaft, to the wheel. At this point a most interesting departure was made from some of the old-line construction practices. It was decided to take the thrust of the propeller on the transmission case through the short length of torque tube which was used from the original car installation. This torque tube was fitted into the ball-and-socket joint on the transmission. Between this ball-and-socket joint and the flange joint was placed a collar, which was the housing for the tapered roller-bearing race, mounted within it. The inner race of cone was mounted on the short length of propeller shaft. This takes the forward thrust from the propeller. The rear thrust, as in reverse, is taken by a small ball bearing, similar to those used beside the differentials to take the ring-gear thrust. This arrangement was placed ahead of the collar and within the torque tube. Of course, the shaft must be provided with the proper collars and forms for fitting the universal at the front, the bearings in the center and the flange at the rear.

This job was installed in a 28 by 8-ft. cabin scow. The first trip was a cruise of about 300 miles from Cincinnati to the Kentucky river and up that tributary and return. The speed of the boat is about 8 miles an hour but this can be raised quite a little on occasion. Last fall this boat won third place in the cabin-scow race at Cincinnati. The engine was not touched during the season's use and this extended well into the fall months. When taken down a short time ago, everything was found to be in perfect condition.—Ray F. Kuns, Cincinnati, Ohio.

Hand-Wrought Colonial Latch

Colonial finish on doors and gates is not complete until fittings such as hinges and latches are made to match. The illustration gives all details necessary for the construction of such a latch. It is of the lift type and consists of a plate and the latch. About ⅛-in. iron plate is used and the handle can be made of a ¼-in. iron strip. The catch is made of 3/16-in. material. To give the surface the old wrought appearance, heat it and then hammer on an anvil. The edges are flanged to give depth and rigidity. The handle and latch are cut to shape, the former being heated and bent at the lower part. Holes are drilled and rivets driven in. After riveting, the upper section is bent back to form a comfortable grip. The catch is cut to shape, the holes are drilled and the catch end squared off. The retainer for the latch is a scrap of base plate. A loose hinge rivet and the rivets for the retainer are then put in. In some cases it is necessary to operate the latch from the opposite side of the door. The method of accomplishing this is shown, the second handle being made of the



Antique Appearance of Doors Is Increased by Fitting Them with Homemade Colonial Door Latches

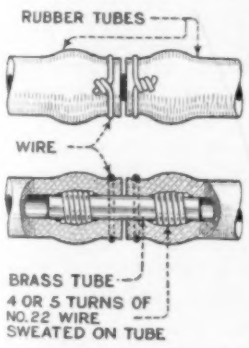
same material as the lift. The thumb lift is of 3/16-in. plate and should be made long enough to pass through the gate and provide at least ½-in. engagement with the latch. The latch plate must, of course, be slotted to clear the movement of the thumb lift.—G. A. Luers, Washington, D. C.

Vacuum Cleaner for Dusting Fruit

Last summer at picking time we had many dust storms, which coated our fruit with dust, detracting considerably from its appearance when packed for the market. To overcome this trouble we tried blowing the dust off with a vacuum cleaner and found this method very effective.—Mrs. M. W. Annis, Shafter, Calif.

Tight Joints in Rubber Tubing

In joining two lengths of rubber hose, it is not good practice to stretch them over a piece of brass tubing that is slightly larger in the inside diameter than the hose, as the joint will leak after the rubber stretches. Get a short length of brass tubing the same diameter as the inside diameter of the rubber and wind four or five turns of No. 22 copper wire around each end, sweating it in place. This can be done by means of a small alcohol lamp, which can be obtained at almost any hardware store. This collar of wire should be about ¼ in. from the end of the tube so that the rubber tubing can be slipped on more easily. After the rubber tubing is forced over the collar, twist a wire around the end, as indicated in the illustration. You will then have a good coupling, which will not leak and, if used to convey air, will easily stand a pressure of 80 lb. per sq. in.



¶A fountain for the lawn can be provided by inverting a flowerpot and pushing the hose nozzle up through the hole. This fountain can be moved about by yanking the hose and without wetting the feet.

Spring Hooks Hold Cows' Tails

A Wisconsin dairyman, whose barn is equipped with the most modern conveniences in every respect, conceived the idea of providing, at each stanchion, the chain-suspended spring hooks shown in the drawing, to prevent the cows from switching their tails about while being milked. The chains are attached to the left side of each stanchion and can be easily and quickly attached or detached by the dairyman.

Bellows Blow Carbon from Cylinders

Garages equipped with a compressed-air outfit can easily dispose of carbon dust when grinding valves by blowing the dust out. Where compressed air is not available, the mechanic usually blows it out with the mouth, getting his face full of carbon and his lungs choked as a result. The illustration shows how a local repair man, doing a one-man business, makes use of a pair of old-fashioned bellows for this purpose. He keeps them in the tool kit at all times, and when scraping carbon or doing any job that collects dirt and dust on the work, he blows everything clean with a stroke or two of the bellows.—L. B. Robbins, Harwich, Mass.

Rake Cleans Lawn Thoroughly

My father had me rake up a dirty lawn. When I got through I had only gathered up half the stuff. I had a rubber band in my pocket and by slipping it on the coarse-toothed garden rake, the small bits that would otherwise slip through were caught easily. The band is slipped over and under the teeth a short distance above the edges as shown.—Walter Brown, West Brattleboro, Vt.

Holder for Medicine Dropper

When medicine is to be measured carefully, it is annoying to find the dropper has been mislaid or broken among other bottles or containers in the medicine chest. To make it convenient and safe from breakage, a Wisconsin doctor places a label of double thickness on the bottle, attaching it so as to form a pocket, as shown in the illustration. The double label makes the pocket strong enough to prevent tearing and the dropper is always convenient for use.

Smoke Locates Leaks in a Roof

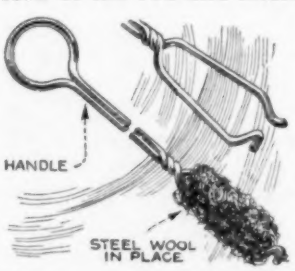
Instead of waiting through several rainstorms to locate all the leaks that may be suspected in a roof, they can be determined all at once in this manner: Close all windows and doors and plug up any opening that can be seen in the top of the building. Make a fire in a large kettle or iron washtub and place it on the attic floor under the roof. A good fire for this purpose must be a sort of smudge, which will give off plenty of smoke. It may be of punky, wet wood, or pieces of cedar bark twisted together, dampened and then laid over a small, hot fire in the center of the receptacle. Where plenty of straw is available, throw some wet straw on the fire. When the smoke is thick, go up on the roof and you will see small spirals issuing from every leaky place in the roof. Chalk such spots and then mend the roof before the next rainstorm, and it is safe to assume that you will have a tight roof. The smudge will also help to eliminate all kinds of insect pests.—L. B. Robbins, Harwich, Mass.

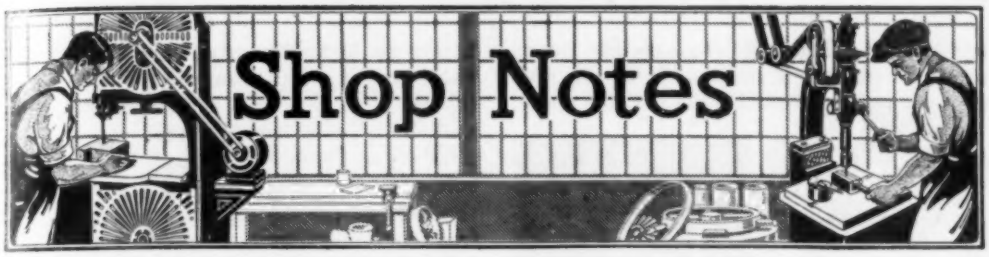
Mending Tissue Made from Rubber-Tube Cement

Mending tissue used for holding together small breaks or tears in clothing can be easily made from ordinary rubber-tire cement. All that is necessary is to flow the cement upon a waxed or oily paper. It can be made as heavy as desired, and, when dry, can readily be peeled off the paper. In use, it is placed on the underside of the cloth and a hot iron is applied, with a piece of clean cloth between the iron and the rubber to act as a protection and to hold the edges of the break together.—B. Murray, Sturgis, Mich.

Cleaning Shotgun Barrels

Being at a loss to find a suitable rod and brush to clean the barrel of a rusty shotgun, I procured a length of No. 10 gauge wire, which I doubled and bent as shown in the drawing. By placing a small quantity of steel wool in the open fork of the rod and latching the ends together by means of the hook provided, I made a cleaning rod that did the work in a most practical manner. The construction of a rod of this kind also has the advantage that the worn wool can be removed instantly, and new wool substituted as quickly.—G. E. Hendrickson, Argyle, Wis.





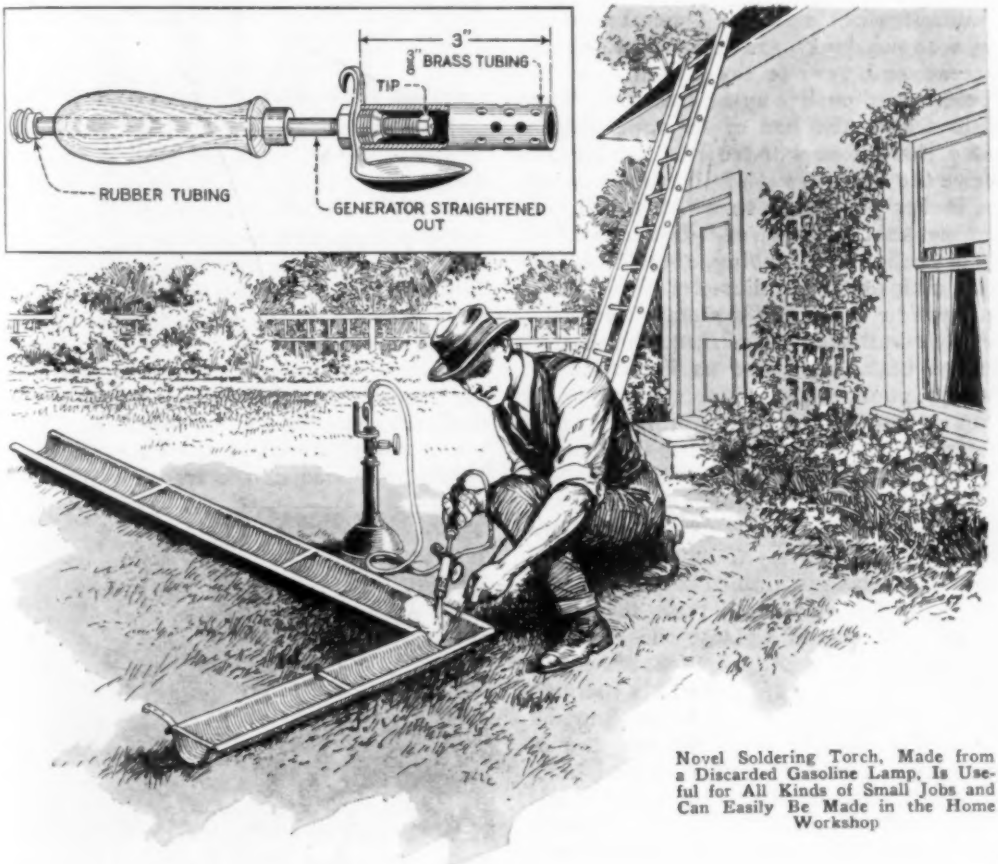
All Shop Notes published in 1925, in book form—Fifty Cents—from our Book Department

Blowtorch Made from Gasoline Lamp

By L. B. ROBBINS

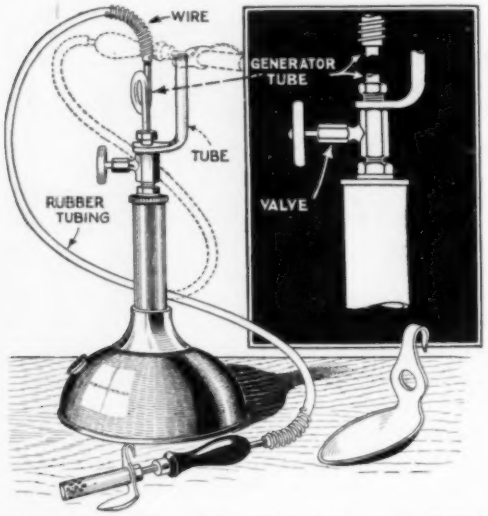
MANY modern gasoline and kerosene lamps operate on the principle of the plumber's blowtorch, the gasoline in the fount being projected into the burner in the form of vapor, where it is ignited and consumed in flame. A lamp of this type can be converted into a useful soldering outfit as shown in the illustrations. As the fount holds 1½ qt. of gasoline and the burner is small, one filling of fuel will last a long time.

First remove the air chamber at the top of the lamp, the mantles and the generator. Leave the vertical air-intake tube standing. Saw off the generator about 3 in. above the locknut and force the shredded asbestos out of the tube. Then replace it and attach a length of thick-walled rub-



Novel Soldering Torch, Made from a Discarded Gasoline Lamp, Is Useful for All Kinds of Small Jobs and Can Easily Be Made in the Home Workshop

ber tubing, wiring this on. A few turns of stiff wire near the metal tube will prevent the tubing from kinking at this point.



Construction Details and Assembly of the Blowtorch

Straighten out a second generator in the vise so no kinks are left. Saw off the spread end, reverse the direction of the locknut and push it up near the tip. Then drill a hole, the size of the tube, lengthwise through a wooden tool handle and drive the tube through it, leaving a couple of inches projecting to which the rubber tubing should be wired. Get a piece of thick-walled brass tubing, about 3 in. long and with an inside diameter that can be tapped to take the generator locknut. Drill several small holes through this tube in the unthreaded end as indicated. A heavy spoon, with a wide shank, should be fashioned as shown and a hole drilled in the handle of such size that the generator tube will be a force fit in it, while leaving sufficient material outside to cover the end of the large tube completely. Now assemble the parts. The generator tip should rest about a third way down the length of the perforated tube, the spoon shank should bear against the threaded end of the tube, and the locknut should be screwed up tightly against it. If the generator tends to slip or air spaces show, fill these with hard solder. The top end of the spoon shank is bent to form a hook so that the burner can be hung up.

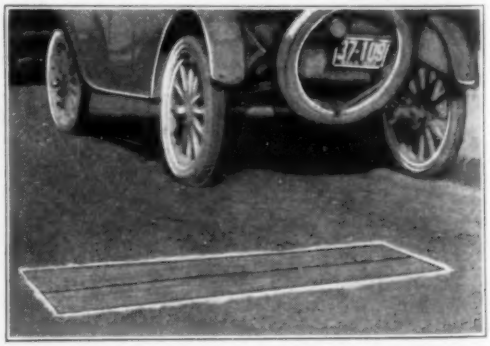
To start the outfit, pump air into the lamp fount, burn a little gasoline in the spoon to heat the tube, turn on the gas valve and light the burner. If the tip is in the right position in the burner tube and the holes properly placed you will get a nice blue flame, hot enough for any light soldering. Experimenting in enlarging the hole in the tip and in varying its distance from the burner end will get you the best results. When found, a drop of solder will hold it permanently in position.

Assembling Bendix Drive on Ford Starter

When assembling the bendix drive on a Ford starting motor, take care to see that the stop nut or bearing, which enters the mounting bracket on the starting motor, is not too tight, and that the bearing is in proper alinement with the bracket. The bearing should be oiled and then fitted so that it can be readily turned with the fingers. If the bearing is too tight, dress it down with an oilstone, as too tight a fit will cause the bearing to freeze to the bracket, which will result in serious damage to the starter.

Planks Keep Trench Openings Smooth

Keeping pavements smooth at trench openings, where the pavement cannot be relaid until the back filling has settled properly, and where the tires of passing vehicles keep pulling out the backfill, has been solved in one city by placing planks in the trench. Two or more 3-in. planks, wide enough to fit the opening in the pavement and cut to the proper length, are placed in the opening, the backfill being graded so that the plank surfaces are flush with the top of the pavement. The planks are lifted out at intervals and more backfill is added as the trench settles.

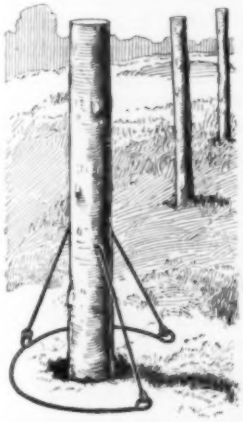


Planks Used to Cover Trench Openings in Pavements

How to Braze Band Saws

The proper way to braze band saws is to make a lap joint by beveling the ends for a distance equal to about two teeth. The blade is clamped so that the ends overlap in the center of the clamp. After applying a little powdered borax in the lap, a small piece of silver solder, about the size of the braze, is inserted. Heat the brazing tongs to a red heat and press them against the joint firmly, holding them there until the tongs cool to a dull red. The tongs are then slid back and forth along the blade a few times to insure a uniform braze. Then the cooled joint is carefully filed down to a uniform thickness.—William C. Thomas, Chicago, Ill.

Brace Keeps Heavy Posts Upright While Tamping



When he had to set a number of heavy fence posts in concrete, a mid-west farmer found the task seemingly impossible without the aid of an assistant to hold each post perpendicular while the concrete was poured and tamped into the hole around the post. As help was not available, he devised the simple brace shown in the drawing. A length of ½-in. round iron was bent to the shape of a horseshoe with loops at each end and one at the center. To each of these loops a pointed standard of the same material was attached, the points being bent slightly inward. To support a post set in the hole the brace is placed as indicated and the hook points of the three standards are forced into the sides. The post is safely and securely held in this position and the operator is free to tamp the cement and gravel around it. If made in a larger size, the same kind of support could be used to brace telephone poles as very little support is necessary to hold a pole in position when it is once erect.

Grooved Roller for Glaziers

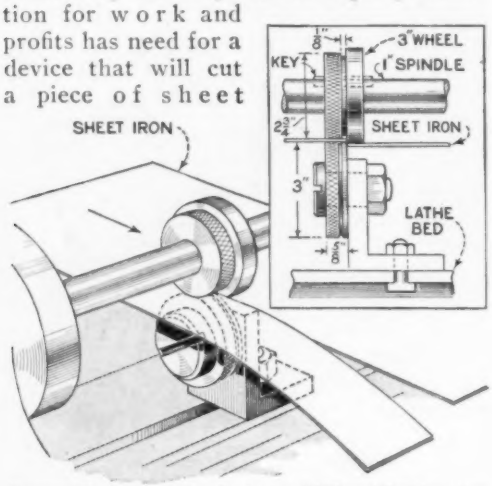
To simplify the application of putty to window sash, a Wisconsin glazier devised the illustrated grooved roller. The putty is placed on the mixing board and rolled out to the desired thickness, after which it is cut into V-shaped strips with the roller. A strip, 8 or 10 in. in length, is used each time and can then be smoothed on more readily than when applied with a putty knife.—G. E. Hendrickson, Argyle, Wis.

Cutting Holes in Thin Sheet Copper

Having occasion to cut a large circular hole in a tank of thin copper and having no tool on hand for this purpose, the one shown in the illustration was improvised in a few minutes and found entirely satisfactory. All that is needed is a drill and bit, a machinists' C-clamp, two short pieces of wood and an old hacksaw blade. These parts are assembled as shown in the illustration, the center hole first being drilled so that the drill fits in it and serves as a center. A cut is made in the end of one of the blocks of wood to hold the saw blade securely. The teeth prevent it from sliding up in use when the pressure of the clamp is applied and the grooves on the drill keep it from turning in the blocks when the device is used. The jaws of the C-clamp must be placed between the drill and the saw blade.—W. N. Lurcott, Weehawken, N. J.

Lathe Rigged Up for Use as Rotary Metal Shears

Nearly every day the average small machine shop that depends on rapid production for work and profits has need for a device that will cut a piece of sheet



Rotary Shears Run by Lathe or Milling Machine Are Useful for Small Shops

metal of medium gauge. We were recently called upon to make four ventilators using about 20-gauge sheet iron. As we had no tools except ordinary hand snips, and I knew that the job would be a tiresome one, I did some figuring, which resulted in the rotary shears shown in the drawing.

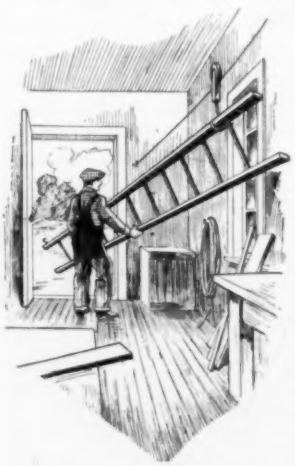
The outfit consists of two circular cutters, each of which is mounted on a suitable shaft and is partly knurled to grip the metal while cutting it. The device is set up in a lathe or milling machine and one man can easily operate it. The upper cutter is made of tool steel, turned down to 3 in. in diameter, and has a 1-in. hole to fit on an arbor to which the cutter is keyed. The smooth part is 3¼ in. in diameter. I did not grind the cutter, as we were in a hurry, but it was hardened in oil. Do not forget to undercut it as shown, or you will be unable to sharpen it. The lower cutter is turned to 3 in. in diameter, but only three-fourths of the face is knurled. It is held in place and rotates on a stud driven into an angle-iron bracket, which in turn is clamped down securely. When assembling the device, care should be taken to bring the rolls together firmly but not tight in a horizontal direction. One-half the thickness to be cut is the proper space between the knurled parts of the cutters. The lower cutter should, of course, be lined directly under the upper cutter. In using the shears no pressure is required to follow the line. It took about three hours to make them, and they saved considerable time.—Omar Fluharty, Sciotoville, Ohio.

Simple Method of Protecting Railroad Ties against Fire

One of the hazards troubling the railroads is firing of ties, piled along the tracks, by sparks from passing locomotives. Those made from fat pine, which are desirable for their lasting qualities, or those treated with creosote to prolong their life, are very easily ignited. A roadway supervisor has adopted a successful plan of preventing these fires by covering the piles with a 4-in. layer of earth which is jammed down tightly, so that no cracks are left between the ties. Any projecting ends of ties at the sides of the piles are similarly protected, a shovelful or so of earth on each piece being sufficient to give ample security against fire.—L. M. Jordan, Newton, Ala.

Handy Ladder Support

Getting the ladder out of the shop or putting it back is much simplified by using the device shown in the drawing.



A wire is stretched from one end of the shop to the other and a pulley is placed on the wire with a hook heavy enough to hold the pulley vertically. When the ladder is withdrawn the pulley and hook will be at the entrance of the building where the ladder may be hung on and pushed back in place readily.—F. E. Poister, Morrill, Kans.

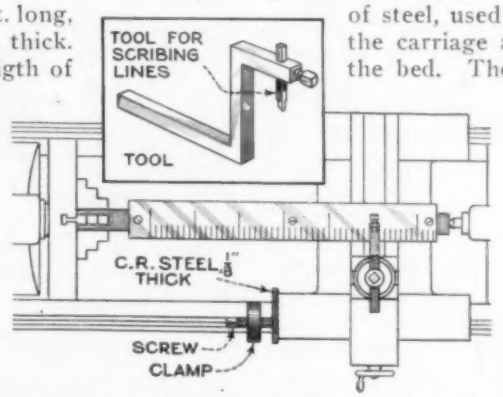
Removable One-Man Truck Body

A wrecking company in San Francisco has equipped one of their lumber trucks with a removable body for hauling bricks because the limited extent of their trade in this commodity did not warrant the expense of a special truck for this purpose. There are two rollers provided on the bed of the truck to facilitate moving the body. To remove the body from the truck, the rear roller is turned by means of a bar until the body is moved to the position shown in photo No. 1. The rear end is lowered to the ground, as shown in photo No. 2, but the body is kept from slipping off the truck by means of two steel straps bent to form hooks. These catch the rear roller, holding the body in the position shown. When this has been done the driver slowly backs up until the empty body stands vertically on end and the truck is ready to be used for hauling lumber. In placing the body on the truck again, the driver backs the truck up to the body, which is standing vertically, pushes the body over, until it strikes the roller on the rear of the truck, then drives forward until the roller on the rear engages with the two steel straps. Now he can easily lift the rear end of the body and push it forward on the rollers. All the operations are easily and quickly performed by one man.—C. W. Geiger, San Francisco, Calif.

Special Body Built by a Wrecking Company for Hauling Brick; It Can Instantly Be Removed or Attached to Truck by One Man

Graduating a Six-Foot Scale in the Lathe

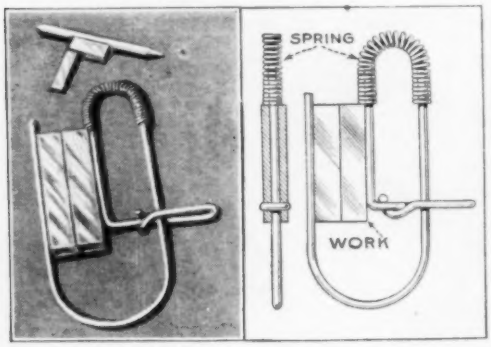
A small jobbing shop had only a lathe, drill press and shaper. A tailor brought in a piece of brass, 7 ft. long, 2 in. wide and ⅛ in. thick. He wanted a 6-ft. length of this marked in ⅛-in. graduations to be used for measuring cloth. We first fastened the brass with screws to a piece of machine steel, 7½ ft. long and 1½ in. square. This was placed in the lathe, as shown, and an indicator was used to line it up on the top and side. The 1-ft. graduations were measured off with an ordinary scale, and the 1-in. and the ⅛-in. graduations with a 1-in. and ⅛-in. length of steel, used between the edge of the carriage and a clamp stop on the bed. The cross slide and the scribing tool shown in the upper detail were used to do the marking. This method, of course, will not make a precision scale but the job was quite sufficiently accurate to serve the tailor's requirements. — C. Moran, Philadelphia, Pa.



Graduating a 6-ft. Metal Scale in the Lathe for Use as Tailor's Measure

Spring Clamp Facilitates Laying Out of Blocks in Pairs

In cases where it is necessary to mark off a large number of blocks in pairs, the

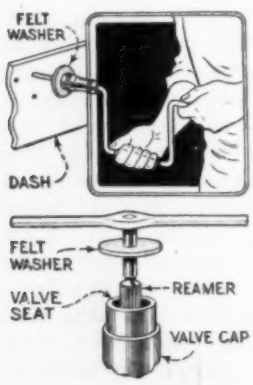


Spring Clamp Facilitates Marking Off Blocks by Handling Two at a Time

spring clamp shown in the illustration has been found to be of considerable assistance. The clamp is made of two pieces of 3/16-in. wire held together by a coil spring as shown. The tendency of the spring to straighten out holds the clamp tightly against the work. One wire is bent at right angles and looped around to inclose the other, in order to keep both in line opposite each other.—Harry Moore, Montreal, Can.

Felt Washer Protects Painted Surface

When drilling through a painted or highly polished surface such as the dash or fender of an automobile, the drill frequently breaks through and the chuck mars the finish. A piece of leather or felt put over the bit and against the chuck as shown in the illustration will prevent this trouble. Similarly when using a tap or reamer the tool will go through the work suddenly and the handle will strike the work. On gears, valve cages or wristpin bushings, where the teeth may be marred, the valve seat bruised or the face of the piston scratched, such a leather or felt washer put between the tool and the work will prevent this objectionable bruising.—G. A. Luers, Washington, D. C.

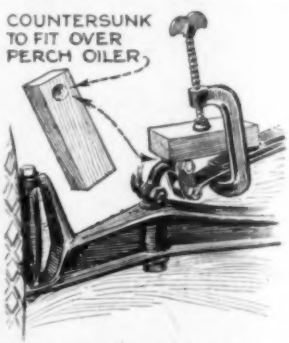


Set Your Own Wagon Tires

Wooden carriage and wagon wheels often lose so much of the natural moisture in spokes, hubs and especially the felloes that the steel tires become loose, and the wheel is soon ruined if used in that condition. Instead of taking it to the blacksmith, soak the wood parts in water until the tire is tight and the wheel, when tapped, gives the sound of solidity. Now, the important thing is to make this setting last at least one season, and this is done with oil or paint as follows: As soon as the wheels are surface-dry, give the wood a coat of kerosene, and again let it, too, become surface-dry. This allows the oil or paint to penetrate deeply enough to hold, as keeping moisture in the wood depends on a cover of paint or oil. Now apply a good wagon paint, or linseed oil of which one-third is drier.—Louis Murback, Poultney, Vt.

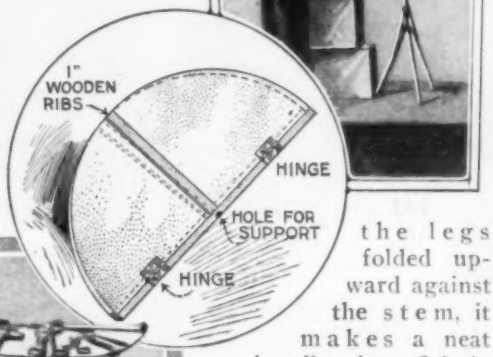
Device for Changing Spring Shackles on Ford Cars

When fitting new spring shackles and bushings on a Ford, either on account of wear or failure altogether, do not jack up the body to take the weight off the springs. They can easily be changed by using a C-clamp of suitable size and a strip of hardwood, say, 1 by 2 by 8 in. in dimensions, and clamping it in position, as shown, recessing it to fit over the oiler in the spring perch to avoid damage to the oiler. Screwing up on the clamp will cause the shackle bolts to slip out. With the usual type of coil-spring shock absorbers, a clamp can be used without a wooden strip.—C. S. Bartless, Dallas, Tex.



Portable and Collapsible Tool Table

Mechanics often carry their tools along to a job and when they get there they may have to work for long periods on their knees or standing on a stepladder. Where several tools are used, convenience and a considerable saving of time can be accomplished by having the tools at all times readily accessible on a small portable and collapsible tool table of the kind shown. It is adjustable to any range of height up to the worker's head, and the top revolves, so that any tool can be brought within easy reach. The table is durable and exceedingly light, and can be carried in a tool box, when collapsed. It is made from an ordinary metal music stand, which can be obtained for a few dollars. With the iron rod deep in the stem and the legs folded upward against the stem, it makes a neat bundle, about 2 ft. in length, weighing less than 4 lb. The flat top consists of two semicircular pieces of heavy sheet metal, hinged together and reinforced underneath by light wooden ribs, as shown. A hole in the center of these ribs fits over the upper end of the stand. The table can be adjusted to any height from 18 to 60 inches.—P. C. Grose, McComb, Ohio.



Collapsible Workbench, Which Is Light in Weight and Can Readily Be Carried in the Tool Chest, Facilitates Work of a Mechanic

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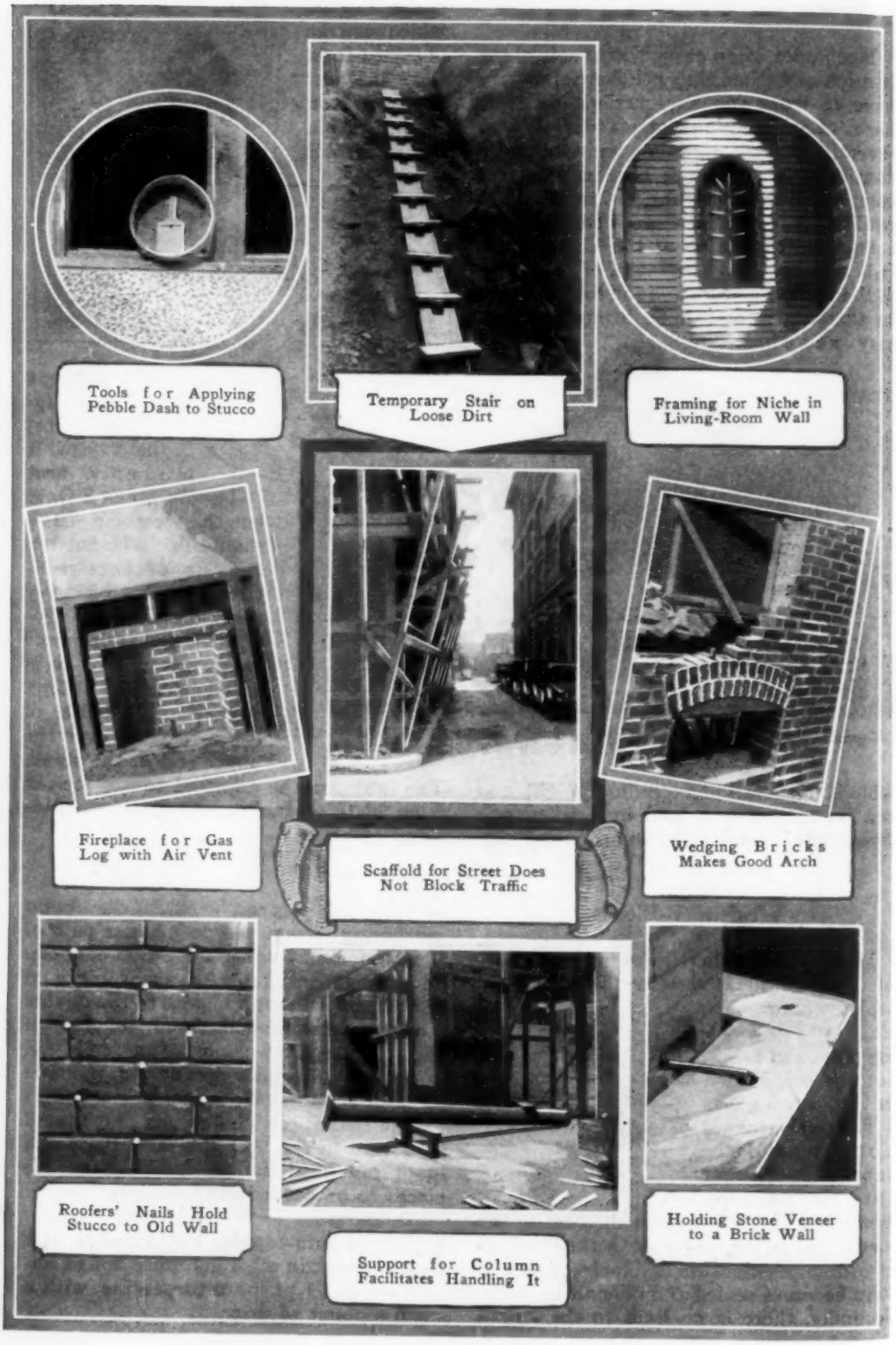
Welders' V-Blocks

Most welding shops possess some kind of V-block arrangement for lining up broken shafts, rods, etc., or butt-welding pipes and tubes, but the one shown in the drawing has a few advantages not commonly known. In the first place the lining-up member is well away from the heat of the torch, and is not underneath the work as in ordinary extension V-blocks, where it soon becomes scaled and difficult to move. Secondly, there is no limit to the length to which the vees can be extended. As no machinery is required to make a pair of these blocks, smaller repair shops can adopt them profitably. Take a piece of ¼ or ⅜-in. flat stock, bend it to the double V-shape shown and then cut the piece in half. In use, the work to be welded is laid in the vees on one side and any suitable piece of round stock is laid in the others to line them up. The alining rod should be placed in the vees first and these slid in or out until the two portions of the pieces to be welded are balanced.

¶A good auto-top dressing consists of 2 lb. lampblack in oil, 1 gal. pure boiled linseed oil and 1 pt. pure turpentine, with a small amount of drier.

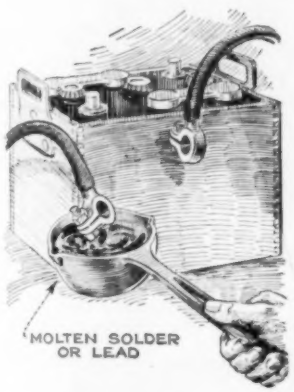
KINKS THAT HELP THE BUILDER


Tools for Applying Pebble Dash to Stucco
Temporary Stair on Loose Dirt
Framing for Niche in Living-Room Wall
Fireplace for Gas Log with Air Vent
Scaffold for Street Does Not Block Traffic
Wedging Bricks Makes Good Arch
Roofers' Nails Hold Stucco to Old Wall
Support for Column Facilitates Handling It
Holding Stone Veneer to a Brick Wall

Glass for a Surface Plate

The other day I needed a surface plate; something that would be fairly accurate. I looked over the workshop but could find nothing that would answer the purpose. Precision surface plates are expensive and for the little use we have for them yearly, it really does not pay a farmer to buy one. I needed the surface plate badly and had about given up when I happened to think of a broken windshield which we had left from an auto accident. We never dreamed that it would be of any use whatever, but, while it was not perfect, it served as a dandy surface plate and will answer for pretty fine jobs in any farm or other workshop. In going over the matter with a mechanic recently, he decided to get one for himself after he had examined it.—H. W. Swope, Danville, Pa.

Protection against Corrosion of Battery Terminals

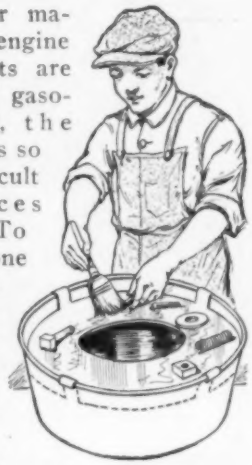


On automobiles where battery terminals are subject to considerable corrosion, it is a good idea to tin the terminals. This can be done best by dipping them in melted solder or lead up to the insulation on the cables. The clamp screws and nuts should also be tinned. A method of doing this, which has been found practical and satisfactory, is to melt the solder or tin in a ladle and then dip the terminal in it, as shown.

Belt-Saving Trick

A great saving can be made in a shop where there are many belts, if the following method is used: When the belts are to be laced, punch out holes large enough to insert eyelets in the holes. It will be found that the holes, especially in rubber belting, will not become worn so quickly.

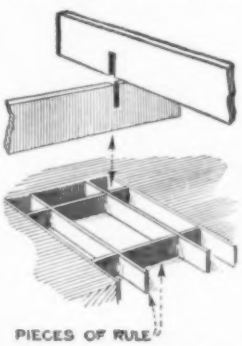
Washing Parts in Gasoline



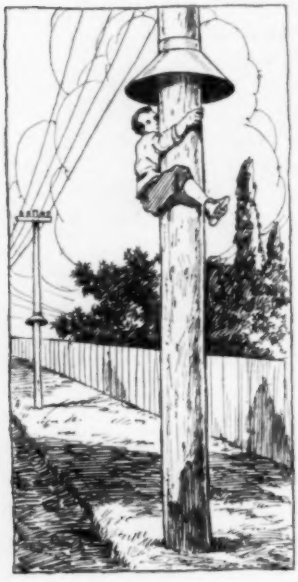
In the garage or machine shop, when engine or machine parts are placed in a pan of gasoline to be cleaned, the liquid often becomes so dirty that it is difficult to locate the pieces when wanted. To overcome this, one mechanic employs the novel drain table shown in the illustration. A disk, somewhat smaller than the diameter of the pan top, is cut from a piece of heavy tin, leaving projections or ears at four points. A circular hole is cut out of the center of the disk and the ears are bent over the edge of the pan to hold it. Parts are placed upon this drain table where they may be readily brushed and cleaned with gasoline and left there until the surplus gasoline has drained off.—G. E. Hendrickson, Argyle, Wis.

Printers' Emergency Furniture

It sometimes happens in printing offices that there is no metal furniture of the required size. This makes it necessary to resort to numerous emergency methods, the most usual of which consists in filling up the space with lead slugs. The drawing shows a convenient and simple method of filling large spaces by making furniture of the proper size from pieces of rule or slugs. Pieces of the proper length to fill the space are cut and notched on a saw trimmer, which is found in nearly every plant. These notched pieces are put together and then placed in the space to be filled, as shown in the illustration.—A. C. Cole, Chicago, Ill.



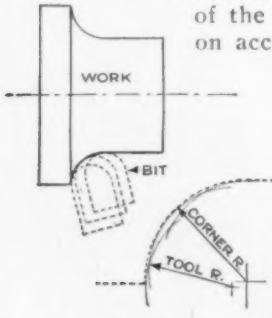
Safety Guard on Power-Line Poles



Children frequently climb telephone and power-line poles and serious accidents have often resulted from contact with live wires. To prevent this, the Louisville Gas and Electric company provided guards made of sheet metal and attached these to the poles, as shown in the illustration. This was found to discourage the children from using the poles for climbing.

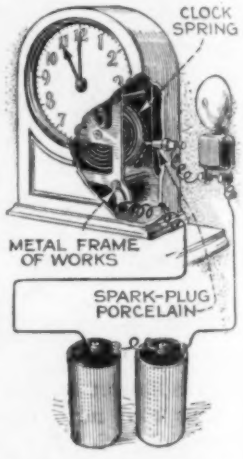
Cutting a Radius Corner

Cutting a corner on a given radius is something many machinists consider impossible without the liberal use of a file, and this is more or less difficult where a high degree of accuracy is involved. A good method of accomplishing this job with ease is shown in the drawing. The edge of the cutter is first ground to produce a radius about one-tenth smaller than the finished radius of the piece. This will make the actual radius of the tool even smaller on account of the angle at which the upper surface of the tool is tipped. With the shape of the corner roughed out with other tools, begin to use the special cutter on one side, then on the opposite side, and then at the center, shifting the tool as soon as more than one-third to one-half of its lip starts to cut. This work is done best with the power shut off and the belt operated by hand. The result of cutting in this manner is to remove a fine chip of metal at each cut, which eliminates chattering as the tool never gets a grip on much metal. A series of small shallow ridges will be left, but these are so slight that they disappear after a few light strokes with a fine file. The completed job will be well finished and accurate. It is also possible, with this method, to merge the arc of the corner exactly with adjoining surfaces.



Electric Alarm Indicates Unwound Clock

One of the janitor's duties in a large manufacturing plant is to see that the master clock is kept wound and running on time each day. After several lapses of memory, when he allowed the clock to run down, he devised the following simple method of warning when the spring was nearing the end of its operating power. He drilled two holes in the side of the case, one near the bottom and the other directly opposite the side of the spring. An insulated electric wire was run through the lower hole and bolted to the metal frame of the clockwork. The top hole was reamed out just large enough so that a spark-plug porcelain could be forced tightly through it. This porcelain was connected to a second wire and the wires were connected to a battery and doorbell in series. The contact point in the porcelain was adjusted a certain distance from the spring so that, when it was nearly uncoiled, it would touch the point and close the circuit, ringing the bell.



¶To make a battery box acid-proof, melt 8 parts of wood tar and 14 parts rosin in an iron kettle, then stir in 10 parts fine brick dust; apply solution warm after the box has been cleaned and sandpapered.

KINKS THAT HELP THE BUILDER

Hood over Pulley Protects It from Debris

Hot-Air Vent Held Securely by Ears

Framework and Bracing for a Rubble Pier

Sturdy Hanger for Heavy Soil Pipes

Stone-Filled Barrels for Temporary-Line Poles

Pipes Held on Floor to Prevent Moving

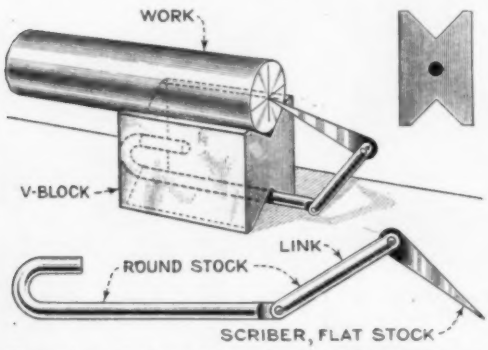
Strap Irons on Plank Ends Prevent Splitting

Quickly Erected or Dismantled Wooden Derrick

Convenient Platforms for Cornice Builders

V-Block Centering Device

One of the quickest methods of marking the center of short lengths of round work is to use the handy V-block attachment



Convenient Scriber Mounted on V-Block Centers Round Stock

shown in the drawing. It consists of three pieces: a block having a "V" cut on two opposite sides; a length of rod fitting in the bottom "V" and bent over so that when put in place the end slips into a hole drilled in one end of the block; a length of the same-size rod pivoted to the end of the first piece, and a scriber, made of flat stock, pivoted on the end of the link. Any size of work can be marked off and a further advantage is that the work need not be square on the end, as the scriber readily accommodates itself to irregular surfaces. In use, the scriber is moved downward and the shaft turned and marked in two or more places, the point of intersection being the center.—Harry Moore, Montreal, Can.

Hulling and Scarifying Clover Seed

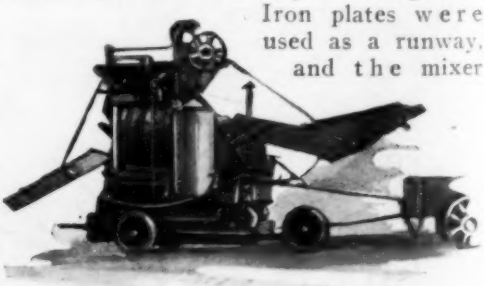
We have grown our own sweet-clover seed for several years and thresh it with our grain thresher. It does not hull the seed, but this work and the scarifying are done in one operation in the following way: A quantity of coarse, sharp sand or gravel is obtained; this is dried, and then run through a fanning mill so that all sand particles smaller than a clover seed are screened out. A bushelful of the coarse gravel, which passes through the fanning mill, is placed in a barrel-type concrete mixer and a bushelful of the unhulled clover seed is put in with it. The two are tumbled together for about 15 minutes. Both are passed through the fanning mill with a screen that will allow the clover seed to screen from the gravel. The wind blast removes the loosened hulls and the seed is clean and well scarified by the scratching the sharp gravel gives it.—Wendell N. Mitchell, Rogers, Nebr.

When to Paint Vacuum Equipment

New pipes or cylinders in which a vacuum is to be maintained should not be painted until after the plant is set in operation and a vacuum is being maintained within the parts. The reason is that all metal is more or less porous, and when it is new, it allows leakage. If painted before using, the thin coating on the outside soon gives way. It should be painted while in use with a thin-mixed paint as this allows the pores to become filled, and the result will be a very noticeable increase in the vacuum.

Trailer Carries Concrete Mixer

Having a number of widely scattered jobs to do, a western construction company built a heavy trailer for one of its trucks to carry a big concrete mixer, in order to transport it faster than it could travel on its own power. Four wheels with solid rubber tires were used. They were put on axles fastened to a triangular framework of iron beams, a small beam being placed at the front end to keep the mixer from running onto the wheels at this end, which were very close together. Iron plates were used as a runway, and the mixer



Large Concrete Mixer Transported from Place to Place on Heavy Trailer

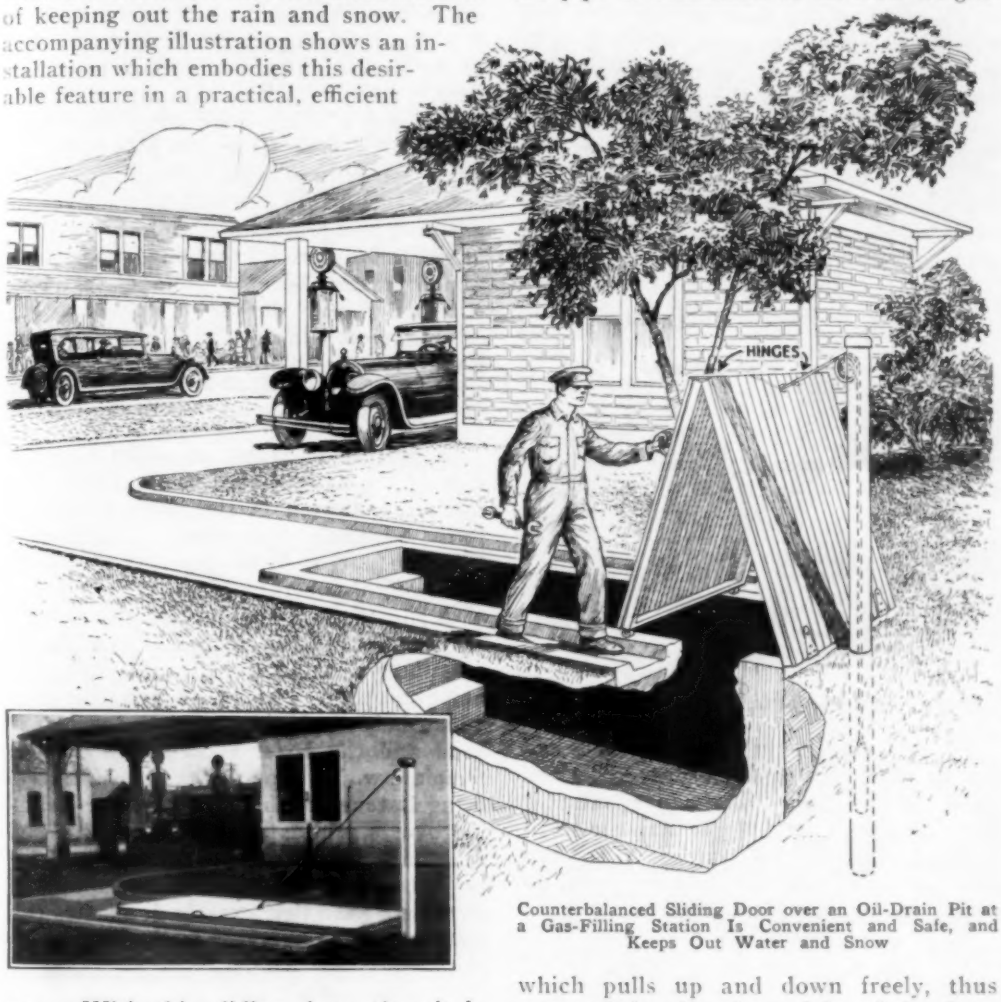
run up on the low framework under its own power.—A. Flinner, Wichita, Kans.

¶Paraffin rubbed on woodwork with a soft cloth will remove all dust and dirt.

Novel Sliding Door on Drain Pit

By DALE R. VAN HORN

ONE of the objections to the open drain pit usually found at gas-filling stations is that there is no convenient method of keeping out the rain and snow. The accompanying illustration shows an installation which embodies this desirable feature in a practical, efficient way. With this sliding door, the pit is kept closed at all times except when a car is to be drained. It is a matter of a few seconds for the operator to raise it to an upright position and attend to the car in the usual way. Since the door is counterbalanced with a weight inside of a vertical pipe (indicated by the dotted lines) only a little effort is required to open or close it. The pipe should be about 4 in. in diameter and extend 5 ft. above the ground, its total length being sufficient to allow it to be solidly set and give the weight freedom to run the necessary distance. A pulley is set into the side of the pipe and a cable runs over the pulley. The end inside of the pipe is connected to an iron weight which pulls up and down freely, thus counterbalancing the weight of the door. A cap is screwed on top to exclude moisture. The door itself is made in two sections. Each section is of the same length and slightly wider than the pit. One section is hinged to a piece of 2 by 4-in. wood, which is mounted on the end of the pit by means of bolts whose heads are imbedded in the concrete. The other section of the door is hinged to the first section by means of ordinary hinges. Both sections are covered with matched lumber, with cleats on the inside, and the edges are trimmed with material, 1 in. thick and 3 in. wide.



Counterbalanced Sliding Door over an Oil-Drain Pit at a Gas-Filling Station Is Convenient and Safe, and Keeps Out Water and Snow

When the door is down these hinges fit along the edge of the concrete pit. A handle is provided on one section of the door. To facilitate opening and closing the door it will pay to attach small casters to this half of the door so that they will ride on the concrete edge, which is built in the usual way. Steps lead down to the bottom of the pit for the worker. No dimensions are given as these are hardly necessary because each filling station proprietor has his own ideas about a pit. The installation shown is used in a number of cases in and around Kansas City and is proving entirely satisfactory.

Handy Radiator-Filling Funnel

Simple Funnel Facilitates Filling Auto Radiators

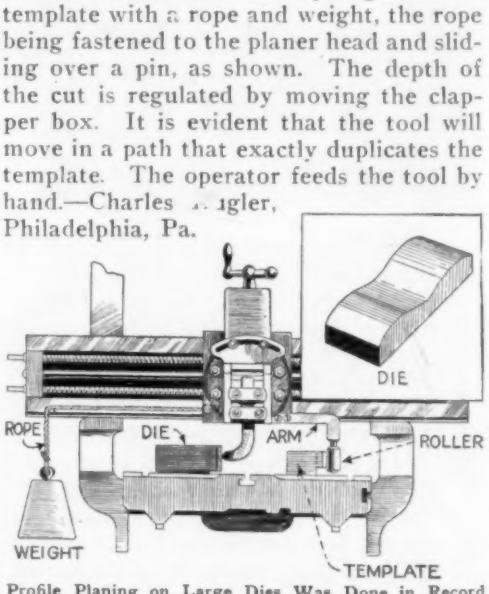
By soldering a tin funnel, which had lost its neck, to a cap of a glass jar it was made into a very satisfactory radiator filler. A hole, a little larger than the small opening of the funnel, was cut in the cap and the latter was soldered in place, as shown in the right-hand figure.

Test for Foul Air in Wells

Inexperienced well workers often lose their lives by going into wells without first testing them for foul air. This can be done by lowering an ordinary lantern into the well, as far as possible. If there is any foul air the flame will get dim and if there is much of it the light will go out entirely. The foul air can be removed in the following way: Lower to the bottom of the well an old pail filled with burning charcoal, holes being punched through the bottom of the pail to permit sufficient draft. As the foul air is heated it rises out of the well and fresh air enters to take its place. After the fire has burned for about 10 or 15 minutes it can be removed, and the workers can go down safely. Even if the well is very dirty, carbonic-acid gas or foul air will not collect again for a considerable time, at least not for several days. A pail, a sufficient length of wire attached to the handle, and a long cord or rope, can nearly always be obtained, but a blower and a length of hose are not always procurable. Furthermore, the blower method is not quite reliable. Fresh air can be forced down into the well but a layer of gas may still remain at the bottom. One breath, enough to fill the lungs, may cause almost instant death. The easiest and surest method is the use of a charcoal fire as described.—James E. Noble, Toronto, Canada.

Profile Planing

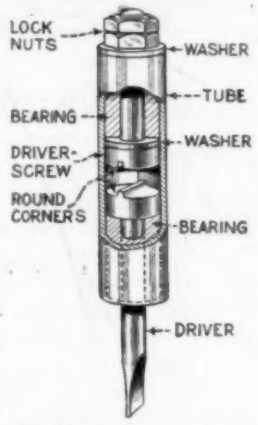
In machining large, cast-iron forming dies of the kind shown in the detail, the method indicated in the illustration was found especially convenient. We made a template out of ½-in. machine steel and clamped this on the planer table. It was a duplicate of the dies, but about 1 ft. longer because the stroke of the planer must be greater than the length of the job being planed. The roller and the arm, which holds it, are screwed to the planer head and the latter is kept against the template with a rope and weight, the rope being fastened to the planer head and sliding over a pin, as shown. The depth of the cut is regulated by moving the clapper box. It is evident that the tool will move in a path that exactly duplicates the template. The operator feeds the tool by hand.—Charles [illegible]igler, Philadelphia, Pa.



Profile Planing on Large Dies Was Done in Record Time by Using Template

Drill-Spindle Screwdriver

When a large number of long screws have to be driven, a fixture permitting the driver to be used in a drill press will be found a timesaver. By running the press at a reasonable speed, the work can be done much more quickly than by any hand method. The device consists of two round stock bearings, a length of steel tubing, a slotted screw and the special driver. The driver head is finished with a tongue in the center to fit the slot in the screw. These two parts are finished first, then, with a washer behind the head of the screw, the two bearings in which they turn are driven tightly into the ends of the tube. Another washer is placed on top of the bearing containing the driver screw, and two locknuts on top of this. These nuts are adjusted so that the screw will drive the screws into the work but will itself turn when the head touches. This forms a friction-slip drive and can be adjusted nicely with just enough tension to drive the screws. The tool is gripped in the drill-press chuck and the work, with the screws started a thread or two by hand, placed on the table. The screw to be driven is brought beneath the tool and the spindle fed down until the slot and tongue engage. The screws are then driven into the work by operating the drill press. The connection is maintained until the screw is finally driven, when the driver screw turns or rather ceases to turn with the machine.

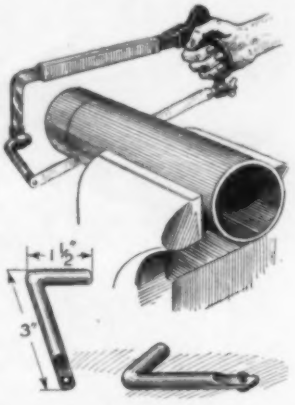


Homemade Heat-Proof Paint

Where a heat-proof black paint is required, the following easily prepared mixture will be found practical. It consists of graphite, 2 parts; Fuller's earth, 10 parts; sodium silicate, 11 parts; glucose, 1 part and enough water to make the mixture applicable with a brush.

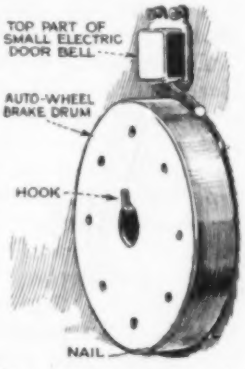
To Increase Capacity of Saw

When it was necessary to cut a large quantity of 5-in. pipe, the handsaw was found just a little too small, both in stroke and depth of cut, making it necessary to turn the pipe three times. To hasten the work and make smoother cuts, a piece of ⅜-in. rod was bent as shown in the illustration, and a pin to hold the blade was set in the flattened lowered end. By using a longer blade, the pipe could be cut through with one setting. The attachment has been left on the saw permanently, as it does other work just as well as before the alteration.—Harold E. Benson, Boulder, Colo.



Factory Foreman's Call Bell

When there is need in the shop or factory for a loud gong, such as is used to call the foreman to the office or announce the starting and quitting time, the installation shown in the drawing will be found useful. Remove the small bell and substitute a brake drum taken from an old auto wheel. Fasten this on with a large screwhook or a bolt bent to L-shape. There should be about ¼ in. clearance between the clapper and the gong shell. Drive three nails into the wall round the edge of the drum, to make it stand out from the wall as indicated. This will prevent muffling of the sound and the bell will give a clear signal.—Earl E. Moffat, Pasadena, California.



Quantity Production of Automobile Name Plates of Type Metal Is Easy Work for Anyone and Only a Few Tools Are Required to Do It

Profit from Making Auto Name Plates

By BRONALDO MURRAY

MAKING automobile name plates for autoists is a profitable spare-time business. Anyone can make a mold, pour the metal, and finish a large number in a short time. The only equipment necessary for this work is a gas plate, or other heating device, a small melting pot, a ladle and a polishing wheel upon which a wire brush and a cloth buffer are mounted.

The material used to make the name plates is ordinary type metal such as printers use in their linotype machines. A little metal antimony is added for hardening. The melting pot should be of iron and the type metal can readily be melted over an ordinary gas flame, or if this is not available, over a gasoline or kerosene-stove flame. A blowtorch can also be used for this purpose. After the metal has been melted, it is poured into a plate-steel mold with a ladle, as shown in the accompanying illustration. The mold is made from two steel plates riveted together. The lettering is cut in one plate with a metal-cutting scrollsaw, which plate is then riveted to the second. After the metal has been poured and hardened, it is dipped in water to cool it. Shrinkage of the metal then takes place, which makes it comparatively easy to remove the name plate. This is done by laying the mold, with the name plate in it, face down on the bench top, and tapping the back side with a light hammer to loosen the plate. The work is finished nicely on a buffer, and dipped in a transparent varnish.

To facilitate fastening of the name plate to the radiator it is advisable to drill two or three small holes through the letters at different points. Bolts, a little longer than the thickness of the radiator, are pushed through the holes and washers and nuts on the other end hold it in place securely.

Emergency Grain-Drill Tube

While using the wheat drill this spring one of the rubber tubes dropped down and wound around one of the wheels, which ruined it. A length of old bicycle

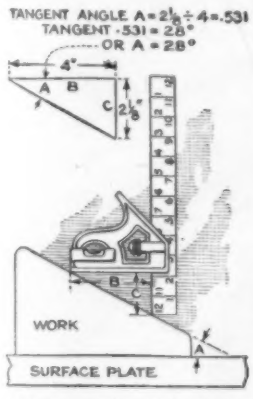
tire was found, and a length of strap iron was placed in it to hold the section straight. This was attached in place of the damaged tube and answered as well for completing the spring seeding as a regular tube.—Geo. G. McVicker, North Bend, Nebr.

Novel Road-Marking System

Road commissioners in St. Joseph county, Mich., have found that they can save labor and material in dividing county highways into two lanes of travel by using white-painted squares every 10 ft. apart instead of applying a solid white band the whole length of the highway. The new method has proved entirely satisfactory.

Method of Measuring Angles

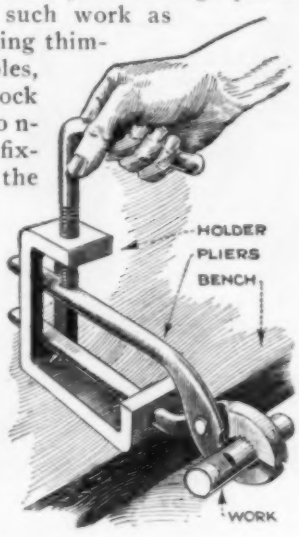
When no protractor head is available, an angle can be accurately measured by the method shown in the illustration. The dimension B is always the same and the distance C is read directly from the scale. First see that the surface plate is level, then mount the square on the work as shown and move the scale up or down until the bubble in the level is in the center. Now two sides of a right-angle triangle are known, and the angle A can be calculated by dividing the length of side C (2⅛ in.) by the length of side B (4 in.), the result in this case being .531, which is the tangent of the angle A. A table of natural functions will show the corresponding angle to be 28°. The application of this method is unlimited, and if a micrometer depth gauge is used to get the exact measurements of B and C very accurate results can be obtained.



¶A good method of curing egg-eating hens is to punch tiny holes in each end of an egg, blow the inside out and then fill the shell with mustard.

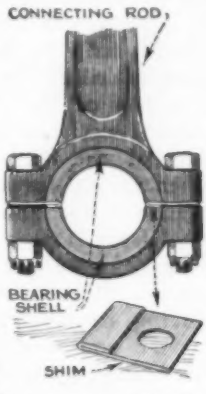
Clamp Holds Pliers to Bench

Considering the facility with which parts are held in the jaws of large pliers and tongs for such work as splicing and fitting thimbles to wire cables, holding bar stock and electric conduit, the bench fixture shown in the illustration should appeal to all mechanics having such work to do. It is made of fairly thick flat iron or steel, and its construction and use are shown with sufficient clearness in the illustration to make any more detailed description unnecessary.—G. A. Luers, Washington, District of Columbia.



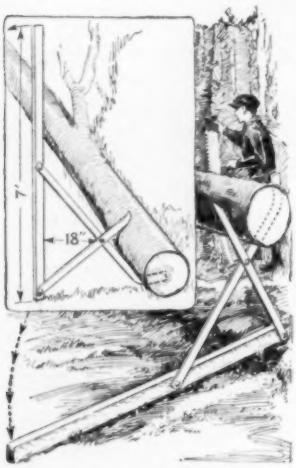
Fitting Connecting-Rod Bearings

Frequently, upon examining connecting rod bearings, it is found that the bearing shells are floating loose in the connecting rod and in the cap, even though they had originally been riveted in place. After reriveting the bearing shells it may happen that their edges are lower than the surfaces of the rod and cap. To remedy this by filing is difficult and tedious work, necessitating repeated checking on a surface plate if an accurate job is to be done. An easier way is to make a number of shims, with the inner edge folded over, so as to press directly upon the bearing shells. If the number of shims and their thickness are correct, the bearing shells will be held permanently in place.—Richard P. Cole, Paterson, N. J.



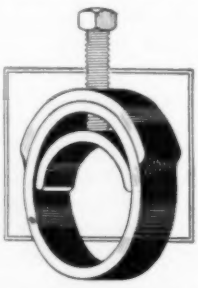
Sawbuck Helps Raise Log

Sometimes it is troublesome to lift a large log up on a sawbuck, but with the buck shown in the drawing the task will always be easy. It has a 7-ft. base made of 2 by 4-in. stock, and the other members are 1 by 4-in. In use the device is placed so as to straddle one end of the log and by pulling the base down, as indicated by the arrows, the log is raised with little effort.—Luther Strosnider, Onago, Kans.



Clamps for Welding

It is often difficult to get a clamp to suit a specific welding need; sometimes the right size is not available, or else the clamp is not sturdy enough to withstand the strain. The clamp shown in the accompanying illustration is strong enough to stand any strains to which it may be put, and is adjustable. In making it, a ring, 1 in. wide and cut from 2-in. boiler tubing, is flattened on the sides to an oval shape. A reinforcement made from a section of a similar ring is fitted snugly around one end of the oval, and the ends of this strip welded to the sides. A 5/16-in. hole is drilled through the top of this reinforced section and the top of the ring, and then tapped for a setscrew. The shoe of the clamp is a piece of ring, 1 in. wide, and is also cut from boiler tubing, bent to fit. A spot countersink is made in the top of this shoe to receive the point of the setscrew. Because of its adjustable feature, this easily constructed clamp comes in handy for many special purposes about the shop or plant.—A. G. Wikoff, New York City.

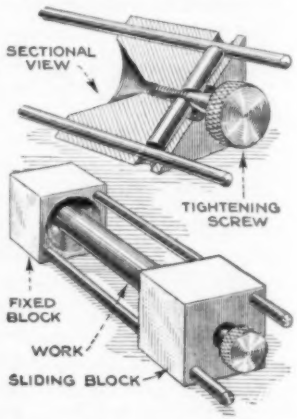


Inside and Outside Coatings for Smokestacks

There is no oil-mixed paint that gives good service when applied to the inner surface of a smokestack or breechings. The best covering is three or four coats of cement mixed in small quantities at a time to the consistency of thick paint and applied with a brush. A wire brush should be used to remove all soot and rust from the crevices before the cement is applied. For the outside, asphalt paint is best and this, also, should be applied only after a thorough wire brushing of the surface.

Quick-Acting Marking-Off Blocks

For holding medium-length round pieces when marking off positions on opposite sides or at right angles, the device shown in the illustration will be found to be a great convenience. Once it is made, the center is known, and, unlike V-blocks, where the height center varies with the diameter of the work, it remains the same for all sizes within its capacity. To make it, two square blocks are cupped out on one side, clamped together, drilled and reamed at opposite corners to take two guide bars. The bars are a tight fit in one block and a sliding fit in the other. The latter is drilled through cornerwise to receive a tightening bar, which consists of a piece of cold-rolled stock drilled and countersunk in the center and sawed in two. A special screw with a tapered point, entering a tapped hole in the block, expands the two halves of the tightening bar against the guide bars. With this device the blocks can be adjusted very quickly



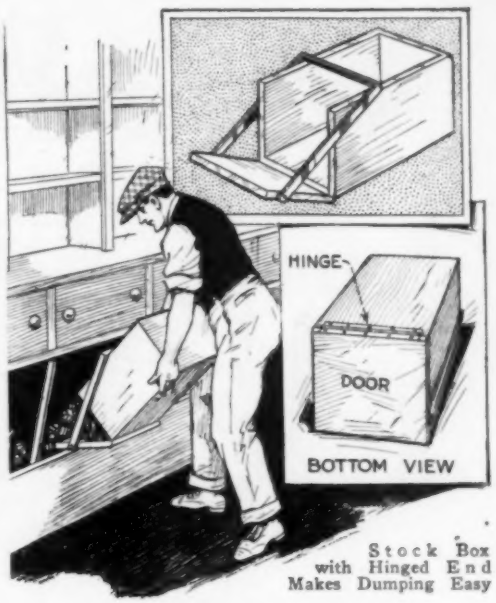
to hold the work. The piece is inserted in the cupped end of the fixed block, and the sliding block pushed up against the other end. One turn of the screw then tightens it in place.

Oil in Boilers May Cause Blistered Tubes

The practice of using oil in boilers to loosen scale and prevent them from rusting, when allowed to cool off or for other purposes, is not good unless care is taken to remove all particles of it with some grease dissolvent afterward. If this is not done, the oil adheres to the tubes or plates and prevents water from coming in contact with the metal. Thus the heat is not carried away from this point and the tube or part may become so hot as to blister and weaken.—Geo. G. McVicker, North Bend, Nebr.

Waterproofing Shipping Tags

Shipping tags bearing order numbers, addresses and other essential information can be waterproofed to prevent the writing from "running" by the simple method indicated in the drawing. Get an open glass jar, about 8 or 10 in. in height and large enough to allow your hand to enter freely. Suspend a 60-watt lamp in the jar as shown. Turn the current on and shave enough paraffin so that, when melted, it will come up to the top of the lamp. It is then an easy matter to dip the tags in the melted paraffin, and this will effectively waterproof them. After use, the lamp is turned off and the paraffin is allowed to harden around it. When ready to use it again, just turn on the lamp and in a few minutes the paraffin will be melted so that tags can be dipped in it. The tags also will be strengthened by the treatment.—E. V. Wills, Chicago.



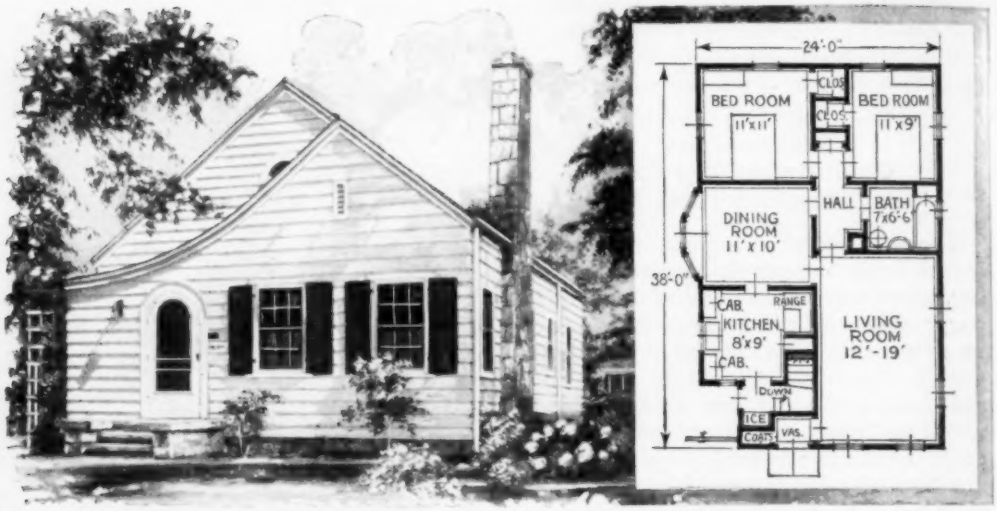
Stock Box with Hinged End Makes Dumping Easy

Stock Box with Hinged End Saves Time in Store

A useful box to have around a storeroom, where small parts are kept in bins, is one with a hinged end like that shown in the drawing. For dumping a boxful of parts into a bin without loss of time nothing could be handier. With ordinary boxes the user must tip them up to empty the contents, with the not uncommon result that some of the pieces are scattered on the floor. The other way is to ladle the contents out by handfuls, which, of course, is slow. We took an ordinary wooden box and knocked out one end of it, then made a new endpiece, the full over-all width of the box, and hinged it at the bottom. Next we bent an iron strap, to fit close over the box lengthways, and attached the ends to the hinged lid with a screw on either side. It is quite easy to unload this box into a bin even at shoulder height from the floor. It is lifted up and the hinged end is pushed a little way into the bin. The strap is then raised and pushed forward to open the lid. Tilt the box slightly, shake it, and the contents will slide out.—H. Moore, Montreal, Can.

¶Taps should never be screwed down hard; if this is done, their washers wear out quickly, and the taps begin to leak.

This May Be Your Home



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Plan No. 5D33

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THE plan presented here was awarded an honorable mention by the jury in a recent competition for a five-room bungalow. The charm and simplicity of the exterior of this small bungalow are easily seen.

The rectangular shape of the floor plan permits a simple and direct roof treatment, without hips and valley, resulting in economy of construction and a low skyline. This low skyline aids materially in creating the satisfying impression of hominess and intimacy between the house and its setting.

The living room is of good size and proportion. If a fireplace is desired in this room, it could be provided at the end adjacent to the furnace flue, without much difficulty or additional expense. The dining room is conveniently located, with a deep bay window to make it sunny and cheerful. The two bedrooms occupy corner positions and thereby are able to have cross ventilation. Each has a large clothes closet.

The kitchen is in the front of the house and is lighted and aired from two sides. The entrance to both kitchen and basement is protected by a trellis, so that the coming and going of the butcher, baker and candlestick maker will be unnoticed.

Materials used: Frame construction with wide wood siding or heavy shingles for exterior finish.

Width: Twenty-four feet. Depth: Thirty-eight feet.

Approximate size of lot: Thirty-five feet.

Facing: The house should be faced so as to take advantage of prevailing winds, sunny exposure and local views. The plan shown here can be reversed, if desired.

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